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# THE AMERICAN GAS LIGHT JOURNAL

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*The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.*

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[OFFICIAL NOTICE.]

### Twenty-first Annual Meeting, American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., September 21st, 1893.

*To all Members:* The Twenty first Annual Meeting of the American Gas Light Association will be held in Chicago, Ills., beginning October 18th, 1893. The headquarters will be at the Victoria Hotel. The meeting will be called to order at 10 o'clock, on the morning of Wednesday, October 18th, by the President, A. E. Boardman.

The following papers are to be read:

1. "Purification by Iron Oxide," by Geo. T. Thompson, St. Louis, Mo.

2. "Gas Engines in the United States," by Fred. H. Shelton, Philadelphia, Pa.

3. "Rate of Purification," by J. A. P. Crisfield, Savannah, Ga.

4. "Relation of Temperature to Purification," by Jas. Somerville, Indianapolis, Ind.

And probably two others.

This year the questions submitted for the Question Box will be printed and sent out with the papers, so that if you have any queries to propose, they must be sent to the Secretary *at once.*

The meetings of the Association will be held at Kinsley's Hall, No. 105 Adams street.

Special attention is directed to the Bulletin Board which will be placed in the lobby of the Victoria Hotel, as there may be some very important notices in regard to the meeting, which may be condensed to one day, in which case an evening session may be called.

Cards will be provided at the door for the members and visitors to register as they enter the meeting room for the *first* time, thereby obviating the necessity for the roll call. Name and post office address to be written on the card, which will be taken up by the doorkeeper.

The Committee of Arrangements not having yet reported the details of their work, the Secretary is unable to announce their programme, or that any special hotel accommodations may be expected for any large number at any one place, owing to the crowded condition of the city.

The Secretary especially calls the attention of those members whom it may concern to the fact that, in accordance with the Constitution, all members whose dues remain unpaid for a term of three years, will be dropped from the rolls.

There are over 90 members who are at least one year in arrears. Are you one of them?

All applications for membership must be in the Secretary's hands on October 8th.

Further announcements that may be made will appear in the JOURNAL.

A. B. SLATER, JR., Secretary.

[OFFICIAL NOTICE]

### Call for Council Meeting.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., September 21st, 1893.

*To the Members of the Council:* There will be a meeting of the Council of this Association early in the evening of October 17th for the transaction of the usual and such other business as may be brought before it. The hour and place will be supplied to this notice in the next issue of the JOURNAL, and all Council members will be individually notified by mail.

A. B. SLATER, JR., Secretary.

[OFFICIAL NOTICE.]

### The American Gas Light Association's Greeting to European Gas Engineers.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., June 5th, 1893.

*To the European Gas Engineers—Greeting:* The American Gas Light Association will hold its 21st annual convention in the city of Chicago, beginning on the date of Wednesday, October 18th, 1893. It

would give the members of the Association great pleasure to meet there as many of the European gas engineers and managers as can make it convenient to be in attendance at the World's Fair at that time. It is suggested that all contemplating visiting the Fair arrange their visits so as to be in Chicago, if possible, at the time of this convention, when they will be most cordially welcomed by the Association and invited to attend the sittings of the body and participate in its discussions of papers presented.

Those engineers who cannot conveniently visit the World's Fair at that time, but must choose some other date, are respectfully requested to send their names and addresses, as soon as they arrive in America, to the AMERICAN GAS LIGHT JOURNAL, No. 32 Pine street, New York City, so that a committee from the Association may be made aware of their presence, and when they may be met, so that they may form the acquaintance of their professional brethren in this country and be made to feel less like a "stranger in a strange land."

A. E. BOARDMAN,
President.

A. B. SLATER, JR.,
Secretary.

## BRIEFLY TOLD.

THE CHICAGO MEETING.—Secretary Slater, in our current issue, prints his first official statement respecting the meeting in Chicago, next month, of the American Association. As will be seen in its lines, the head quarters named makes the rallying place the Victoria Hotel, which served so admirably the purpose in similar respect last May for the Western Association, and the meeting room, too, is that which gave shelter to the Western—Kinsley's Hall. The paper list is of great promise, the five named numbers being all on topics directly related to the industry; and these, with the more than suggested presentation of a sixth paper, together with that which the Question Box can be confidently counted on to develop, are sure to afford plenty of technical matter to occupy the members during the business sessions. In fact, it is satisfactory to know that the coming of-age session of the American Association, even though the assemblage is to be in the very height of the glory and bustle of the great Fair, will be up to every technical requirement. The inability of the Committee of Arrangements to hand in at this time anything like a completed programme is accounted for on the ground that it is quite difficult to satisfactorily arrange for some time ahead matters of such nature in the World's Fair City just now; still our readers will likely find in our next number that the Committee has been in every sense successful. The general circular, besides appearing in the JOURNAL, will be mailed to individual members.

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COAL TAR AND THE TARIFF.—The following timely letter, the pertinence of which cannot fail to be appreciated, ought to stir up the makers of coal gas to the importance of acting speedily on the lines suggested:

DUBUQUE, IOWA, Sept. 18, 1893.

To the Editor AMERICAN GAS LIGHT JOURNAL: I observe that among those who, on September 16, appeared before the Committee on Ways and Means of the House of Representatives to discuss the revision of the tariff is one gentleman, engaged in the dyeing industry, who, whilst asking protection for his own business, also urged that coal tar, an article he uses, be put or kept on the free list. I beg to suggest to those concerned that the gentleman's recommendation is unworthy of adoption. The McKinley bill reduced the tariff on coal tar, or, rather, if my recollection is correct, it put tar on the free list. At the same time a tariff charge of $3 each was imposed upon clay retorts used in coal gas manufacture. Since that time it has cost more to make coal gas, one reason for which is that coal tar, one of the most valuable bye-products, now brings to companies manufacturing coal gas only one half the price obtained for it previously to the enactment of the McKinley bill. The interests benefited by keeping coal tar on the free list seem to be chiefly these three: The English gas companies, who send large quantities of tar and pitch to this country; electric light companies, which are benefited by anything that increases the cost of production of a rival illuminant; makers of water gas apparatus, whose processes will be employed if thereby gas can be produced for less than the cost of production of coal gas. I also believe the large companies which distill coal tar, obtaining therefrom many valuable products, wish to retain the tariff on these products, whilst deriving them from the same cheap coal tar their English would-be competitors use. I beg to represent to the managers of coal gas works that their representatives in Congress might be pleased to be advised in these particulars before the House or the Committee finally considers the matter of a tariff on coal tar.

Very respectfully, MISSISSIPPI.

## Small Gas Undertakings and Differential Prices.

[By Mr. Norton H. Humphrys, in the London *Journal*.]

A "small" gas undertaking, in gas engineering parlance, is something more than merely a concern that does a limited extent of business. It is further understood as being placed at a disadvantage by reason of its smallness, inasmuch as it cannot make gas so cheaply as its larger neighbors. There is a limit, which may be roughly taken at an output of 100 millions per annum, beyond which it appears that any further increase in productive capacity is not attended with additional economy in working. At any rate, undertakings of this size are able to make and sell gas as cheaply, all things being considered, as a gas works of the first magnitude. In the South of England, the total expense involved in delivering gas of the usual quality at the meter of the consumer may, for the purpose of argument, be taken at about 1s. 8d. per 1,000 cubic feet; and to this must be added, in order to give an average dividend on the whole of the capital of 6 to 7 per cent., which is about the usual rate, 10d. to 1s. per 1,000 cubic feet. This brings the selling price of gas, under the best conditions, to 2s. 6d. In the North of England, and where gas coal is cheaper, the working expenses will run considerably less. But it will be sufficient for the present purpose to call 2s. 6d. the "economic limit."

The relations of any one gas undertaking to its consumers will be largely affected by its position in respect to the economic limit. Many of them are fixed at a long distance from it by special local circumstances, which no one can control; the most general being a limited demand for gas, which places the annual output at something far below the 100 millions. Some that are right in the matter of size may be loaded with capital—the results of extravagant or unskilful expenditure in years gone by, of heavy legal expenses incurred in fighting opposition or in amalgamations, of considerations for goodwill and such like extraordinary charges, or of loss of business—rendering a charge of 1s. per 1,000 cubic feet insufficient to afford a reasonable profit for the shareholders. Or they may perhaps be geographically situated in a locality that necessitates heavy cost for carriage, or other items that go to largely enhance the working expenses. So there are several causes, apart from the question of magnitude, that may force up the selling price of gas to 3s., 4s., or even 5s. per 1,000 cubic feet, and that with a less percentage profit, and not a greater, than in places where the gas is cheaper. Under the most favorable circumstances, it will be found that, with a sale of only 5 to 10 million cubic feet of gas per annum, the working expenses will run to another 1s., and the sum required for interest to nearly as much; bringing the selling price to something like 1s. 6d. or 2s. more than the economic limit. So that, whereas the undertaking producing 100 millions, and free from the drawbacks just mentioned, may sell gas at about 2s. 6d. per 1,000 cubic feet, the other cannot do so under 4s. or 4s. 6d. In the first case, the directors and manager are exempt from, and have no knowledge of, a great deal of trouble and worry that has to be encountered in the second. They have no reason to fear threats of competition, and the extension in the use of gas for purposes other than lighting takes care of itself, leaving them nothing to do but to keep up with it. A speaker at a recent meeting of American gas managers lamented that he had put down plant for the purpose of lighting the public streets by means of electricity, but at the last moment had lost the contract. The large gas undertaking rarely meets with anything like this; but small ones know what it is to provide extensions of plant such as a long length of main, in the reasonable hope of securing an important addition of business, and to have their hopes shattered, and an extent of plant that forms no inconsiderable part of the whole left idle on their hands. They know what it is for a large factory, which has hitherto taken perhaps 20 per cent. or so of the whole make, to be shut up and left to fall to ruin, burying a respectable portion of their own profits in the process. They know what it is, in a residential district, to have 50 per cent. of the houses in a street standing empty for months or even years together. The large undertaking is fairly sure of a rising market; but the small one is not so.

In addition to the above, there is another consideration that is of great importance in connection with this question as applied to small undertakings. In their case, a large proportion of the plant must necessarily be in excess as regards productive capacity. A 10 or 20 million plant can be duplicated at a surprisingly low cost, if it has been skilfully laid out in the first place in view of such enlargement; and the difference between increasing it 50 per cent., or doubling it, is a mere trifle. So that, if a small concern finds itself in possession of a badly arranged, obsolete or worn-out plant, or if, from any other causes, the question of extension or renewal is forced upon it, the advisability of doing the thing on a good substantial scale is evident, and under any circumstances, a

reserve is provided that would be unheard-of in large works. The giant can run easily a year or two ahead of his requirements; but the pigmy must move in ten-year jumps. In the large works, it is easy to provide 10 per cent. increments to the plant, with the exception of such a thing as a big purchase of land, now and then. In the small works the addition, if made at all, is one of 50 per cent. or so; and the management has to face such questions as whether it is wise to limit the capacity to 15 millions, when another £100 or so would make it equal to 20 millions.

It will be observed that the economic limit, though expressed in a specific figure, is a variable quantity, not only as regards one undertaking compared with another, but that it fluctuates from year to year, according to the prices of material and labor, and to the state of skill in engineering for the time being. In fact, like the place where the rainbow rests, it recedes from the pursuer, and is never actually reached, and like the cissoid curve, it has no finality. Although the goal of every gas manager, those who have practically attained it for the time being, have not the same incentive to work in its direction as those who are a long way off. New business, in the first instance, is no help towards it; in the second, the greatest aid that can be expected. Here we have the root of the great difference between large and small undertakings, in respect to the present question. In the large way, additional business simply means a *pro rata* increase of working expenses and interest both in the lump; in the small way, it means increase of capital in less proportion, and the opening up of roads for economy in several directions as regards working expenses. The manager of a small works having (say) 30 to 60 per cent. reserve capacity knows that anything like an important step in the way of securing its employment, is also a move nearer to the far-distant economic limit.

Only a short time since, the writer had occasion to investigate an application from a possible user of a large gas engine. The undertaking was only a small one, doing about 6 millions per annum; but the plant had just been enlarged sufficiently to deal with 9 or 10 millions. The present net cost of the gas was 2s. 9d.; and the charge for a 5 per cent. dividend 1s. 4d.—necessitating a selling price of 4s. 2d. per 1,000 cubic feet. In a large sized town the thing would be simple enough. There would be a plain application for the service to be laid on, and the meter would be supplied. But in this case the applicant stated that he should not have the engine at all, unless a large discount could be allowed. The question was, Could any discount be offered; and, if so, how much? It goes without saying that the company would have been only too pleased to secure the customer at the regular rates. The advocates of uniform all-round prices could do nothing in this case but refuse the application. The applicant would have laughed at an offer of a 5 or 7½ per cent. reduction; and the most sanguine anticipations could not realize the possibility of a time when the price might, by repeated general reductions, come down to his views. There was the plain fact that the working expenses and the interest would both be lowered by taking him on.

The only objection was the principle of equal charge for profits on each 1,000 cubic feet of gas made; and this principle is one, as I have already remarked, upon which something may be said on both sides. Would it have been right or reasonable to refuse to give the consumers a real benefit for fear of doing them an abstract injustice? For the addition of this large consumer would be a real benefit to the others, as reducing the working expenses, contributing to the profits, and thus hastening the day when a reduction could be made. Looking at these facts, an all-round scale of discounts, according to the quantity consumed, ranging up to 20 per cent., was decided upon, and the customer was secured. In considering this step from a small consumer's point of view, we have first to determine what constitutes injustice to a consumer. According to Mr. Livesey's views, this is a flagrant instance of such. If one customer has gas at 3s. 4d. per 1,000 cubic feet, he would say that another is equally entitled to it at that price. But most consumers would look at the question from the practical £ s. d. view, rather than from a theoretical or speculative one. Their idea of injustice would be a rise in the price. So long as the profits are not encroached on, either in the form of additional dividends, or of excessive discounts due to selling gas at an actual loss, they suffer no real injury, but on the contrary, will receive, sooner or later, a real benefit in the form of a reduction of price.

There is a great deal of difference in the minds of gas engineers as to what constitutes a "small" and a "large" consumer. The small customer of one town may be the large one of another. Some talk of "small" consumers using 10,000 or 12,000 cubic feet of gas per annum; others put it at half that quantity; and, in many parts of the country, the idea conveyed by the term would be about 2,000 cubic feet per annum. But it is only in the very small undertakings that the large consumer shines forth in his glory. In the large city he is only one among the rest; but, in the small country town, he tells the manager and the directors what they ought to do.

To the small undertaking a user of only 10,000 cubic feet per annum is an important customer. He takes perhaps $\frac{1}{300}$ of the whole output. Apply the proportion to the largest gas undertaking in the world; and we arrive at about 40 millions. A possible consumer of 40 millions, or even of 4 millons per annum would be considered worthy of attention. In the large works no consumer attains such proportions as to be able to influence the fortunes of the concern. But country gas undertakings have to do with individuals who take 10, 20 or 30 per cent., or even a larger proportion of the total production. The entrance of such a customer may double the profits, or his exit may be attended with their entire disappearance. To use an Irishism, the consumers of a small works are all large ones, and those of a large undertaking are all small ones, in respect to their influence on the concern as a whole. Here I would like to say a word about that unfortunate undertaking that figures as the "awful example" in Mr. Livesey's paper, in consequence of having taken the step of offering 1s. per 1,000 cubic feet discount on increased consumption. I do not know the name or any other particulars of the company, but can quite conceive, from actual experience of the affairs of small undertakings, the possibility of circumstances being such as to render the offer a judicious step in the interests of all concerned. I take it the directors see there is available business which cannot be secured without a sacrifice. Whether or not they have offered too much is a matter that can be proved from their accounts. It is certainly a strong remedy; but for some things strong remedies are the only ones. Assume a large surplus of productive and distributing plant, and a high charge (perhaps about 2s. per 1,000 cubic feet) for profit, and 1s. reduction is not too much. There will still remain 1s., and also economies in working expenses, to be divided between the consumers and the shareholders; and the only way in which a real practical injustice would be done would be by either one party securing more than the additional profits, leaving a deficit for the other to make up—in other words, by a reduction of profits, or by an increase in the price of gas. The question has always been complicated from the earliest times by a certain sentimentality; but it would be difficult to produce actual evidence of any person suffering inconvenience or trouble by reason of having to pay another 6d. or so per 1,000 cubic feet for his gas. The only trouble he takes is not to waste so much as when it was cheaper. But it must be observed that the poorest is not necessarily the smallest consumer; nor does it follow that the latter is deserving of special consideration on account of his poverty.

The object of this and a previous communication has been to show that it is only the large or the fortunate class of gas undertakings that can afford to stand out for uniform rates; and that, in the case of those who must necessarily sell at prices considerably above the "economic limit," a judicious system of discounts to large consumers is really the most advantageous for all concerned, whether shareholders or consumers, because it tends to add to the safety and prosperity of the concern on the one hand and to the securing of cheap gas on the other. If the uniform rate is necessarily high, the day consumption and use of gas for purposes other than lighting must as necessarily be small; and any attempt to lower the charge all round to a degree sufficient to secure that line of business would mean a sacrifice of profits for a few years, which is a contingency few shareholders would care to face.

## Glasgow's Oil Heater.

On September 5th U. S. Letters Patent (No. 504,524) were granted to Mr. Arthur G. Glasgow, of Philadelphia, Pa., for an improved oil heater. In the specification the inventor says:

My invention relates to apparatus for the manufacture of water gas, and particularly to the construction of the device known as the oil heater used in the carburization of gas.

The object of my invention is to provide an oil heating device, at once simple, efficient and durable.

The nature of my improvements will be best understood as described in connection with the drawings in which they are illustrated, and in which—

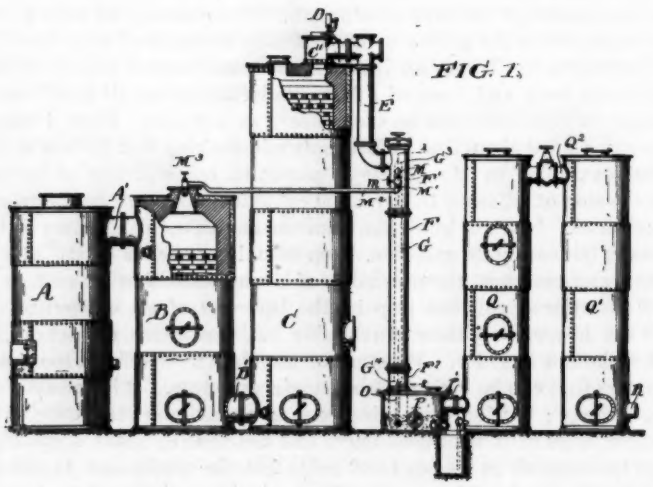
Figure 1 is a side elevation, partly in section, showing a gas manufacturing plant provided with my improvement. Fig. 2 is a longitudinal section on the line 1, 2, of Fig. 1, showing the construction of the oil heater. Fig. 3 is a cross section taken on the line 3, 4, of Fig. 2. Fig. 4 is a cross section taken on the line 5, 6, of Fig. 2; Fig. 5, a central

cross section through the wash box, and Fig. 6 an outline plan view of the wash box.

The gas manufacturing plant to which my invention is applied may be of any convenient construction.

As shown in Fig. 1, *A* is a water gas generator of usual construction, *B* and *C* superheaters or fixing chambers, the gas passing from the generator through conduit $A^1$, to the superheater *B*. Oil is there sprayed into the gas through the oil nozzle $M^3$, and the water gas carrying the oil with it then passes through the previously heated checkerwork in chamber *B* through conduit $B^1$ to the superheater *C*, and through the

FIG. 1.




heated checkerwork in that chamber to the delivery pipe $C^1$. This pipe is open at the top and provided with a valve or lid *D*, which is open to permit the products of combustion to escape while the apparatus is being heated up previous to the manufacture of water gas. When the apparatus is ready for manufacturing gas, the lid *D* is closed and the water gas then passes from the conduit $C^1$ into the conduit *E*, and thence into and through conduit *F*, $F^1$, $F^2$, the lower portion $F^2$ of which passes into the wash box *P*. From the wash box the gas is passed through conduit $P^1$ to the purifier *Q*, thence through conduit $Q^2$ to the purifier $Q^1$ and thence to the main *R*.

The oil heating device is situated in the conduit *F*, $F^1$, $F^2$, and consists of a tube *G*, which is supported in the conduit *F* by a spider *L*, upon which rests lugs *K*, fixed to the pipe *G*, near its top. This spider also insures that the pipe *G* shall occupy a central position in the gas conduit. A socket $G^3$ is welded to pipe *G* near its top and so near the lugs *K* that the expansion and contraction, with the varying temperature, of the distance between them is inconsiderable. To this socket is secured the oil delivery pipe *M*, which should be substantially at a right angle with the oil heater, and which passes through the opening *N* in the gas conduit, and is continued as shown at $M^1$, $M^2$, leading to the oil injector $M^3$; *m* indicates a valve (not essential) in the pipe *M*, by which the delivery of oil can be regulated.

With the bottom of the oil heating tube *G* connects the oil feed pipe *O* leading from the oil supply. The bottom of the tube *G* is contracted as shown at $G^4$. The feed pipe *O* is shown as leading vertically to this contraction as indicated in Figs. 1 and 5, where the pipe *O* is shown as leading first vertically downward, then turning at right angles and passing through an opening $N^1$ at the side of the wash box. But the main pipe *G* may be continued down to the horizontal portion of the feed pipe *O*. Now, it will be noticed that by the above construction the oil heater is supported at or so near the line of the socket $G^3$ that the expansion and contraction of the heater brings no strain upon the outlet pipe *M;* while the spring of the long horizontal portion of the small pipe *O* permits of the full expansion and contraction of the heater without the least injury to any of its parts.

In order to insure greater efficiency in the oil heater I provide an internal rod *H*, running through the center of the tube *G*, substantially through its entire length, but terminating as shown a short distance above the bottom. The top of this rod *H* is preferably welded to the top $G^3$ of the tube *G*, as indicated in Fig. 2, and lugs or spiders *J*, keep it substantially concentric with the tube *G*. I have referred to this device as a rod, but it is preferably constructed as shown in the form of a tube with both ends closed.

It will be noticed that the head $G^3$ is a solid welded head and that the tube *H* is welded to this head. By this construction the necessity for joints or plugs is done away with and there is no danger of any leak at this point. The effect of this centrally located rod or tube is, first, to cause the oil to pass upward through the heater in the form of a hollow cylinder, the oil being thus brought into close contact with the heated walls of the tube *G;* and, secondly, to reduce the volume of oil left in the heater after the end of each run. Any accumulation within the heater tending toward stoppage is removed by an occasional current of steam introduced as at *S*, and discharged through a waste tap, as at *W*. It will further be noticed that the form above described allows the heater to be of welded construction throughout and without separable joints except where the inlet and outlet pipes are connected, and it is so built in practice, avoiding entirely the leakage common in devices for this purpose.

Having now described my invention, what I claim as new—

1. The combination with a gas conduit *F* of an oil heating tube *G*, situated in said conduit, having an oil supply and outlet pipe, and formed with its closed head $G^3$ integral with its sides and an internal centrally located rod *H* secured to head $G^3$ by a welded joint and extending close to its lower end, all substantially as described, so that the hot gas and oil vapor may not intermingle nor escape.

2. In combination with a gas conduit *F* of an oil heating tube *G*, situated in said conduit, having an oil supply and outlet pipe and formed with its closed head $G^3$ integral with its sides, and with a contracted opening in its lower end $G^4$ and an internal centrally located rod *H* secured to head $G^3$ by a welded joint and extending close to its lower end, all substantially as described, so that the hot gas and oil vapor may not intermingle nor escape.

3. In combination with a gas conduit *F* of an oil heating tube *G*, situated in said conduit, having an oil supply and outlet pipe and formed with its head $G^3$ integral with its sides, an internal centrally located rod *H* secured to head $G^3$ by a welded joint and extending close to its lower end and spacing lugs *J* secured to rod *H*, all substantially as described, so that the hot gas and oil vapor may not intermingle nor escape.

4. The combination with a gas conduit *F* of an oil heating tube *G* located in said conduit; an oil delivery pipe *M*, extending through the walls of conduit *F* and secured to tube *G;* an oil entrance pipe *O*, a springy transversely extending portion of which is secured to tube *G;* a steam inlet as *S* into the delivery pipe *M*, and a waste tap as *W*, leading from the oil entrance pipe *O*, all substantially as specified.

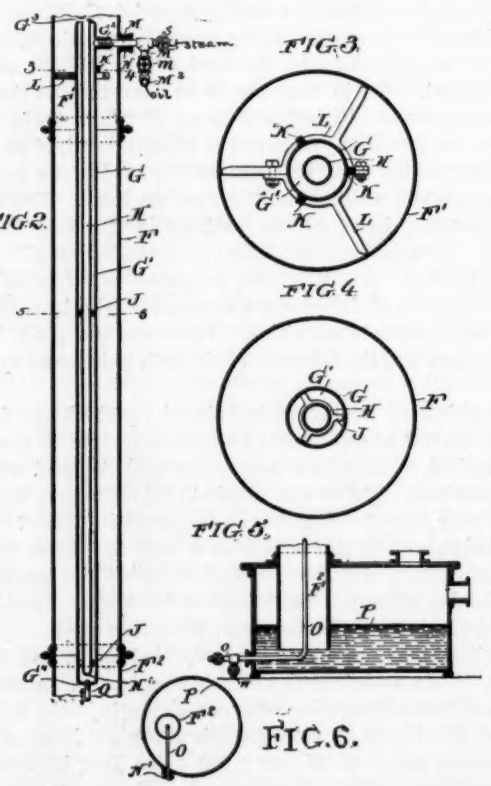
FIG. 3.

FIG. 2.

FIG. 4.

FIG. 5.

FIG. 6.




5. The combination with a gas conduit *F* of an oil heating tube supported at or near its upper end in said conduit, an oil delivery pipe *M* extending through the walls of conduit *F* and secured to the oil heating tube near its point of support in the conduit *F* and an oil entrance tube *O* entering the tube *G* from below the conduit *F* and having a transverse extension lying below said conduit to permit of springing.

6. The combination with a gas conduit *F*, having a spider *L* of an oil heating tube *G* located in said conduit and supported near its upper end

on said spider, an oil delivery pipe *M* extending through the walls of conduit *F* and secured to tube *G* near the spider, and an oil entrance tube *O* entering tube *G* from below conduit *F* and having a transverse extension lying below said conduit to permit of springing.

7. The combination with a gas conduit *F* and a wash box into which said conduit extends, of an oil heating tube *G* supported in said conduit, an oil delivery pipe *M* secured to the tube *G* near its upper end and an oil entrance pipe *O* opening into the lower part of the tube *G* and having a transverse extension in the wash box below conduit *F* in the wash box, substantially as described.

## Swinburne-Thompson Unit of Light.

[A paper read by Prof. Sylvanus P. Thompson, in Section B., World's Electrical Congress, Chicago.]

In the spring of 1892 it was independently proposed by James Swinburne and by the author of this note to adopt as a unit of light of standard quality the light emitted from a unit of area of the positive or crater surface of the electric arc formed between electrodes of pure carbon.

The advantages of this source of standard of illumination over all flame standards hitherto proposed are so obvious as scarcely to need mention.

The advantages over the platinum or Violle unit are also considerable. The carbon arc is much more easily managed, and if a pure carbon is employed, it is much more reliable as a standard than the mass of molten platinum.

The light of the electric arc is emitted, as is well known, chiefly from the end of the positive carbon, very little proceeding from the flame itself, and not much from the negative tip. The positive carbon is, in fact, heated intensely hot over a patch, from which the column of conducting vapor or flame (called by Davy the "arc") is projected across to the tip of the negative carbon. This luminous patch becomes hollowed out into a crater, white hot all over its surface, except at the edges, which are duller and redder, and which volatilize much less, but consume slowly by oxidation when the arc is produced in air. Except at these edge parts the light of the crater surface is of uniform lightness at every part if the carbon be pure. The reason of this circumstance is, as pointed out years ago by the writer, that carbon has a fixed temperature of volatilization. The arc cannot be formed at all unless this temperature is reached, at least at some portion of the surface; and the temperature cannot be exceeded at any point, simply because the volatilization of the carbon keeps it down. The temperature of the crater surface—that is to say, the temperature of the volatilization of carbon—is as definite (if the material is pure and the external pressure constant) as is the temperature of the melting point of ice, or as that of the boiling point of water. It appears to be about 3,500° C.

All arcs made with a pure carbon emit from the crater, save as regards the marginal parts, a light of equal whiteness, irrespective of the strength of current, or of the voltage, or of the length of the arc. Any variations that are noticed in the apparent colors of arc lamps arise either from the semi-incandescent parts around the edge of the crater, or from the tip of the negative carbon, or from the flame itself. If an arc has been burning for some time, with a certain current—say 6 amperes—its crater will have assumed a certain shape or size. If we now increase the current to 12 amperes, the incandescent surface of the positive carbon will be at once increased in proportion, save for a slight discrepancy arising from the marginal effect of the duller parts, and the enlarged crater will settle down to a new shape. These remarks relate to the steady arc, the phenomenon of the hissing arc being still very obscure. If, then, by proper shielding there can be cut off all the stray light of uncertain quality emitted by the red-hot margin of the crater, that emitted by the negative tip and by the flame, so that only the true crater surface is visible, its whiteness, as so viewed through a hole in a suitable diaphragm, will always be of the same unvarying quality. This was the discovery of Captain Abney, F.R.S, in 1878; and it forms the basis of all the splendid work done by him in conjunction with Major-General Ferting, F.R.S., on the photometry of color.

Increasing the current merely increases the size of the crater, but does not alter its intrinsic brilliancy or its color. Increasing the voltage of the arc has no effect on the intrinsic brilliancy or color of the true crater surface. Increasing the length of the arc has no effect on the intrinsic brilliancy or color of the true crater. The amount of light emitted from a square millimeter of crater surface is a fixed quantity, no matter how the current or the voltage or the length may be varied; and not only is the total amount of light emitted from a square millimeter constant, but its composition is constant. That is to say, the proportion relatively of red waves to blue waves is the same always, independent of current, voltage or length of arc.

It was in consequence of the recognition of these physical properties of the true crater surface that the writer and Mr. Swinburne each made the proposition for the establishment of a new unit to supersede the Violle standard.

Since the suggestion was placed before the scientific world, some work has been done towards its realization. In France M. Blondel has described, under the term "arc normal," an apparatus closely resembling that used by Abney in his photometric researches, consisting of an electric arc furnished with a metallic diaphragm pierced with an aperture of known dimensions, but with the addition of a water cooling arrangement. More recently M. Violle has taken up the subject of the electric arc, and has redetermined the temperature of the crater. He adopts and confirms the author's view, that this temperature is determined by the volatilization of carbon. The author has also recently investigated the possible errors introduced by the thickness of the diaphragm and by an obliquity in its position; he has found these sources of error to be by no means negligible. He has also made some experiments on the purity of carbons, and finds that natural graphites always give a less light intrinsically than the artificially prepared hard carbons. Trotter, in his original investigation of the distribution of light as omitted from the arc lamp, announced the different emissivity of the soft carbons used for cores. He also investigated the amount of light omitted (normally) from a square centimeter of hard carbon, and finds it to be something less than 70 candles, or about 7¼ carcels. Doubtless the imperfections of the photometric methods until recent years were such that the production of an exact standard of white light was of less importance than is now the case since photometry has become an art of precision. Professor Ayrton adopting the periodic principle of photometry lately described by the author, and using a photometric screen of the Lummer-Brodhun pattern, finds no difficulty in measuring light with a precision of one part in 500. Now that such accuracy of measurement is possible, there is the more urgency for adopting a standard which is not only of entire trustworthiness, but is also easily reproduced.

## The Foundrymen's Association.

The regular monthly meeting of the Foundrymen's Association was held at the Manufacturers' Club, in Philadelphia, on Wednesday, September 6. The President, Francis Schumann, of the Tacony Iron and Metal Company, Philadelphia, occupied the chair. The minutes of the last meeting were read and approved. The Secretary announced that no meeting of the Executive Committee had been held since the last meeting of the Association, consequently there was no report on the table from that committee. R. A. Register, of Register & Sons, Baltimore, representing the cast iron soil pipe section of the Price Committee, reported progress. He stated that it was probable that there would be a meeting of manufacturers in that line held in New York very shortly for the purpose of discussing the business situation. In regard to the situation he remarked that about 30 to 40 per cent. of the foundries were shut down.

E. E. Brown, of E. E. Brown & Co., Philadelphia, representing the sash weight section of the committee, reported that there was no noticeable change. There seemed to be plenty of orders ahead, sufficient to keep concerns going until the end of the year.

S. G. Flagg, Jr., of Stanley G. Flagg & Co., Philadelphia, representing the small gray iron castings section of the committee, had no report to make. Business in this section remained unchanged.

P. D. Wanner, of the Mellert Foundry and Machine Company, of Reading, Pa., representing the cast iron water and gas pipe section of the committee, reported that foundries were all running, but products were being sold at about cost price. The demand this season for cast iron pipe had been simply unprecedented, and yet it seemed that the capacity for the manufacture of the pipes far exceeded what was warranted by the demand.

The Secretary, Howard Evans, brought up for discussion the subject of an arrangement for chemists' services at low rates for the benefit of members of the Association. He believed that the value of a chemist's services to a foundryman made the subject of importance. Chemists' services were expensive, and the necessary chemical materials added to the expense. The question to consider was whether it would be advisable for the Association to employ a chemist at a regular salary and to equip a laboratory. Mr. Molin, a chemist from New York, had appeared at the last meeting of the Association in support of a plan which he submitted as embodying the requirements of founders in general, and

providing for determinations at small cost to members of the Association. In the course of conversation with members he learned that such of them as had large foundries employed chemists, but the majority of members were without assistance of this kind. He stated that he had been in correspondence with the Drexel Institute, of Philadelphia, on the subject of facilities for making chemical tests, and had received a letter from Prof. MacAlister, of that institution, in which that gentleman expressed his intention of talking the matter over with his brother professors, and his belief that they would be willing to equip a laboratory and make determinations at a very small cost.

The Secretary also read a letter from Mr. Spangler, of the department of chemistry in the University of Pennsylvania, in which he stated that he believed it would be possible to make arrangements for the furnishing of determinations by his department, and that he would do anything that was possible in order to have such work done at the University. He further stated that a consultation with the management would be necessary, and as soon as the matter was in shape he would arrange for an official interview. After considerable discussion the matter was referred to the next meeting of the Association, by which time details would be forthcoming.

The Secretary called the attention of the meeting to an editorial in the *Iron Age* of August 24, last, detailing "A Plan for the Rapid Development of the Foundrymen's Association," a paper submitted by Thos. D. West, of Sharpsville, Pa., to the Western Foundrymen's Association, and making valuable suggestions as to the conduct and location of Associations. In this connection he stated that he had received a letter from Mr. West, asking that the subject be taken up by this Association.

A discussion then took place on the advisability of holding a regular or special meeting of the Association in New York, for the purpose of increasing the membership in that section. The Secretary reported that he had written to one or two members in New York asking whether it would be possible to arrange for a place of meeting at small cost, and that his letters had been brought to the notice of the American Society of Mechanical Engineers, with the result that that Society offered the use of its auditorium for a first meeting without charge, and intimated that in case of meetings in that city becoming a regular feature, a permanent engagement could be entered into on satisfactory terms. After the expression by several members of their views the subject was deferred to the next meeting, when it was hoped the attendance would be larger, and the Secretary was instructed to write the Secretary of the Society, thanking him for the Society's kind offer and informing him that the matter was in abeyance.

The Secretary then read a long communication from John E. Frye, of Pittsburgh, to a member of this Association, in regard to the employment by the Association of a practical and experienced founder, in conjunction with a chemist, for the purpose of making tests and according information to members on all points connected with foundry practice. The communication was ordered to be filed.

Mr. Wanner said that he was of the opinion that a good subject for discussion at an early meeting of the Association would be "The Time for Payment of Wages." Certainly, he said, at the present time, when premiums had to be paid for currency, the subject was an important one. He said he was prepared to move that the Executive Committee take up the subject. After some discussion the opinion of the meeting seemed to be that the question was one largely governed by local customs, and that it would be impossible to institute a regular pay day to suit all sections.

The President brought to the notice of the meeting the requirements of Section 24 of the new Building Law for Philadelphia, approved June 8, last, which section he stated demanded more than passing attention. He read the section, which is as follows:

"Before any iron column, post, beam, lintel or girder, intended to support a wall built of brick or stone, or any floor or part thereof, or to span any opening, 8 feet or over in width, in any building hereafter to be erected or altered, shall be used for that purpose, the manufacturer or founder thereof shall have a distinctive name or title, properly stamped, rolled or cast, in a conspicuous place thereon, and no greater weight shall be placed on any column, post, beam, lintel or girder than the published tables of said manufacturer or founder show it to be capable of sustaining with safety. The inspector may require columns to be drilled for inspection."

This section, he explained, left room for a diversity of opinion as regarded the weights different columns would sustain. One manufacturer might declare a piece of work capable of sustaining 100 tons, while another might declare that it would sustain 1,000 tons, and therefore great confusion in the preparation of estimates would result as well as the possibility of accident. He thought this Association should publish a table based upon standard tables, which table should be adopted as the standard for observance by all founders. J. S. Stevens, of John S. Stevens & Sons, manufacturers of structural iron work, Philadelphia, was of opinion that the plan suggested by the President was a good one, and that the Association should take up the matter as being of importance to every foundryman. After discussion the matter was referred to the Executive Committee.

## Is Carbonic Oxide Dissolved by Iron.

Mr. R. K. Gratigny, writing in *Eng. and Mining Jour.* to the above query, says:

Direct proof of this question either way involves much difficulty. Is the carbonic oxide dissolved in the metal, or is it formed by the action of the escaping oxygen upon the carbon? Before giving conclusions, description of apparatus and experiments is desirable. A bar of very pure "hoop L" iron was secured; composition—carbon, 0.061; silicon, 0.055; phosphorus, 0.016; sulphur, 0.007; manganese, 0.101. This was planed, the shavings dissolved, the impurities were removed, and the iron was deposited electrolytically. It was then redissolved and again deposited; still I obtained a trace of carbon. The iron was again dissolved and precipitated as hydrate. This was placed in a porcelain tube, and the temperature was gradually raised to high redness; purified oxygen was then passed through for three hours; this burnt the carbon and removed it as oxide. After such treatment analysis failed to show carbon.

For melting, a special apparatus was constructed. A small crucible was built up, bit by bit, of pure quartz. To toughen the walls a small quantity of iron filings was sprinkled over the outside; then the whole protected by a layer of magnesia. The crucible top was drawn in to a diameter of 1 in.; to this a 12 in. long porcelain tube was fused. Such a crucible was air-tight. Two glass tubes entered the porcelain neck of the crucible; one, platinum tipped, extended within 4 in. of the bottom. The neck was then stoppered with asbestos, magnesia, etc.; a depth of 2 cm. of mercury above the cork insured tightness. The entire apparatus was then exhausted. A thorough test showed no leaks. Before the final sealing 500 grammes of the pure metal had been introduced. Three oxy-hydrogen blowpipes quickly melted the iron. It was then allowed to cool in this vacuum. The apparatus was now filled with purified oxygen, diluted with pure nitrogen, and the iron again melted. After holding molten for some time, powdered glass was introduced through the platinum tipped pipe. No air entered during this operation, for the tube containing the glass had been exhausted, filled with oxygen and re-exhausted, the glass finally being blown in by a stream of oxygen. This strong acid slag, together with the acid lining, precludes excessive solution of oxides. The blowpipes were turned out and the iron allowed to cool, but under great pressure, which prevented large escape of any oxygen that might be occluded. The crucible was now broken, the iron removed, and the whole outer surface planed off till only bright metal could be seen.

The iron now contains oxygen, but no carbon. It was found impossible to construct a crucible of pure magnesia that would remain air-tight. So a silica crucible was lined with pure magnesia (containing no oxides of carbon). The iron was then placed in this, and the apparatus arranged as previously. The entire system was now quickly exhausted and filled with purified hydrogen, which was forced into a moderate degree of pressure. The iron was again melted. Carbon was now introduced through the platinum-tipped tube. This carbon contained no oxides. It was heated to a very high temperature in a vacuum, cooled and again heated, maintaining the vacuum all the while. Hydrogen was then passed into the tube on the still hot carbon; it was allowed to cool, then again heated and exhausted. No trace of gases was found. Without removing the carbon from the tube in which it had been subjected to the above treatment, it was finally blown into the crucible of molten iron by a stream of hydrogen. All the carbon added disappeared. Of course no allowance was made for oxidation of the carbon, because the atmosphere was hydrogen.

The iron now contains hydrogen, nitrogen, oxygen and carbon. If, on cooling in a vacuum, we obtain hydrogen and oxygen, but no oxides of carbon, we can say that, in this case, carbonic oxide was not formed by any action of escaping oxygen on carbonated metal. Still continuing the pressure, the iron was cooled. The apparatus was then exhausted, filled with hydrogen, and re-exhausted. The blowpipes were then turned on and the iron melted in vacuo. The apparatus was cooled, filled with mercury, and the gas collected for analysis. The gas contained 16.61 cu. cm. of oxygen and 0.96 cu. cm. of carbonic oxide, but

no carbon dioxide. Several blanks were similarly treated, but no gases were found.

Many observers have found carbonic acid and oxide in gases escaping from iron. This experiment would seem to indicate that these gases were dissolved, and not formed by the action of escaping oxygen on the carbon—for in this case oxygen escaped from carbureted metal, and practically neither carbonic acid nor oxide was formed.

With similar precautions a new sample of the pure metal was melted in an atmosphere of carbonic oxide. The gas was collected as before, and contained 0.23 cu. cm. of carbonic oxide and 0.70 cu. cm. of carbonic acid. I would not insist that this one experiment should decide such a question, but will say that with this piece of iron the facts point in a definite direction.

## The Analysis of Lubricating Oils Containing "Blown" Rape Seed and "Blown" Cotton Seed Oils.

By Thos. B. Stillman, Ph.D.

Rape seed oil has long been the standard oil in Europe for lubrication. Its constancy of viscosity at varying temperatures, its non-liability to acidity as compared with other seed oils, and its low cold test, unite in producing the results required of a good lubricant. It, however, is no exception to the rule that vegetable and animal oils suffer partial decomposition when subjected to high temperature produced by friction, with the result that fatty acids are liberated and corrosion of bearings produced.

The substitution of mineral oils in varying proportions with rape seed oil has reduced this tendency, this reduction being determined by the percentages of mineral oil present, as the latter liberates no free acids.

It is a peculiar fact, however, that a mineral oil alone does not give as satisfactory results in lubrication (especially cylinder lubrication*) as does a mixture of mineral and vegetable or mineral and animal oils, one of the primary causes being that the viscosity of mineral oils rapidly diminishes at high temperatures, whereas the reduction of viscosity of vegetable and animal oils is very much less.

If it were not for this peculiarity between these two classes of oils, mineral lubricating oils could easily supplant (on the score of cheapness) all other oils used in lubrication.

The admixture of oils, then, being required for the better class of lubricants, it follows that in England, where rape seed oil has been the standard, its use should be continued in compounded oils.

The proportion of rape seed oil added to mineral oil varies from 5 to 20 per cent. Where the mineral oil is a clear paraffine oil 20 per cent. of the seed oil is used; where the mineral oil is a dark, heavy oil, 5 per cent. is generally added.

The separation and estimation of the rape seed oil in these mixtures presents no difficulty to the analytical chemist when no other seed oil is present, since the saponification of the seed oil, the separation of the fatty acids, and recognition of the same, are a part of the usual chemical work of this character. The recognition of the constituents of a mixed lubricating oil by analysis is a very different problem from giving a formula by which the mixture can be made. This is evidenced as follows: Suppose the analysis shows

Rape seed oil, 20 per cent.
Paraffine oil, 80 per cent.

Paraffine oil varies in specific gravity from 0.875 to 0.921, and it is essential to include in the report of the analysis not only the amount of the paraffine oil, but also the gravity, since paraffine oil of gravity 0.875 is a very different product from that of 0.921 gravity, the former selling at 7½ cents and the latter at 23 cents per gallon. This determination can be made by taking the gravity of the original mixed oil (0.912), then knowing by analysis that 20 per cent. is rape seed oil (gravity 0.918), the gravity of the 80 per cent. of paraffine oil is easily calculated. Thus,

$x$ = specific gravity of rape seed oil (0.918)
$y$ = specific gravity of paraffine oil
$x = 20$ per cent. or $\frac{1}{5}$
$y = 80$ per cent. or $\frac{4}{5}$

Then $\frac{1}{5}x + \frac{4}{5}y = 0.912$

$0.183 + \frac{4}{5}y = 0.912$

$\frac{4}{5}y = 0.729$

$y = 0.910$

The mixture being composed, therefore, of
Paraffine oil (sp. gr. 0.910), 80 per cent.
Rape seed oil (sp. gr. 0.918), 20 per cent.

The direct determination by analysis from the ether solution of the mineral oil in the mixture does not give an oil of the same specific gravity as the mineral had before it was mixed with the seed oil. This can be accounted for by the volatilization of a portion of the lighter hydrocarbons of the mineral oil when the ether is expelled during the analysis. For this reason the determination of the percentage of seed oil and the calculation of the mineral oil offers less liability to failure than finding the mineral oil directly.

The introduction of "blown" rape seed oil instead of the normal rape seed oil complicates the investigation and renders the use of the formula above given valueless. Rape seed oil has a gravity of 0.915 to 0.920. Rape seed oil "blown" has a gravity of from 0.930 to 0.960.

Two difficulties are immediately presented: (1) The chemical analysis does not indicate whether the rape seed oil is "blown" or not. (2) The use of the formula given without the correct gravity of the "blown" oil would give false results regarding the paraffine oil. To overcome this difficulty some synthetical work is required.

Suppose the specific gravity of the mixed oil is 0.922 and the analysis shows 20 per cent. of rape seed oil. It will be necessary then to produce a mixture in these proportions that will duplicate the original sample. A check upon this will be the viscosity of the original sample as compared with the one to be made by formula. Thus:

The original oil has a gravity of 0.922, contains (by analysis) 20 per cent. of rape seed oil, and has a viscosity at 100° F. of 335 seconds (Pennsylvania Railroad Pipette).

*First.* Make a mixture of paraffine oil (sp. gr. 0.910), generally used in this character of lubricant, 80 per cent, and rape seed oil ("unblown"), 20 per cent. The viscosity is 165 seconds, showing that this mixture connot be used in place of the original oil.

*Second.* Make a mixture of paraffine oil (sp. gr. 0.910) and rape seed oil (partially blown, sp. gr. 0.930) in the same proportions as above. The resulting viscosity is 267 seconds, showing that the compound is still lacking in viscosity.

*Third.* Make a mixture of paraffine oil (sp. gr. 0.910) 80 parts, and rape seed oil, "blown" (sp. gr. 0.960), 20 parts. The viscosity is 332 seconds.

This now fulfills the conditions required and the synthetical sample agrees with the original in gravity, composition and viscosity.

The use of "blown" rape seed oil is being gradually replaced by "blown" cotton seed oil. The latter, which has had but a limited use in lubrication, owing to its liability to acidity, has been greatly improved by this process of "blowing," which is nearly complete oxidation of the oil under comparatively high temperature.

This largely prevents the occurrence of the acidity in the oil, and thus the main objection to its use in lubrication disappears. It is much cheaper than rape seed oil, since it costs 40 cents per gallon. to 70 cents per gallon for the latter. The chemical reactions of the two oils are very similar, and careful analytical work is required that the chemist be not misled.

The following table of comparisons will indicate this:

*Specific Gravity.*

| | |
|---|---|
| Cotton seed oil | 0.920 to 0.925 |
| Rape seed oil | 0.915 to 0.920 |
| "Blown" cotton seed oil | 0.930 to 0.960 |
| "Blown" rape seed oil | 0.930 to 0.960 |

*Viscosity (Pennsylvania Railroad Pipette) at 100° F.*

| | Seconds. |
|---|---|
| Cotton seed oil (sp. gr. 0.925) | 165 |
| Rape seed oil (sp. gr. 0.918) | 210 |
| "Blown" cotton seed oil (sp. gr. 0.960) | 2,143 |
| "Blown" rape seed oil (sp. gr. 0.960) | 2,160 |

*Heidenreich's Test.*

| | Before Stirring. | After Stirring. |
|---|---|---|
| Cotton seed oil | Faint reddish brown | Brown. |
| Rape seed oil | Yellow brown | Brown. |

*Massie's Test.*

| | |
|---|---|
| Cotton seed oil | Orange red. |
| Rape seed oil | Orange. |

*Iodine Absorption.*

| | |
|---|---|
| Cotton seed oil | 104 to 114 |
| "Blown" cotton seed oil | 93 to 103 |
| Rape seed oil | 102 to 108 |
| "Blown" rape seed oil | 94 to 100 |

In the comparison of the two oils, when not mixed with a mineral oil, the above tests can be used. The conditions are altered, however, when either one or both are so mixed, since these tests apply only to the

* The *Railroad and Engineering Journal.*

pure oils and not to those reduced with large percentages of mineral oil. After the separation of the seed oil from the mineral oil by saponification the identification of the seed oil depends upon the reactions of the fatty acids obtained, and a careful examination and comparison of these reactions show that the melting points have the greatest difference and thus become a means of recognition.

Thus, the fatty acids from rape seed oil melt at 20° C., and from cotton seed oil at 30° C. Hence, if upon analysis of a lubricating oil under above conditions, the fatty acids obtained show a melting point of 20° C. the seed oil can be pronounced rape seed oil.

If the melting point is between these limits, say 23° C., the seed oils are present in a mixture, the proportions of which can be determined by the following formula:

$w_1$ = proportion of rape seed oil.
$w_2$ = proportion of cotton seed oil.
$w_3$ = weight of mixture (20 per cent.).
$t_1$ = temperature of melting point fatty acids of rape seed oil.
$t_2$ = temperature of melting point fatty acids of cotton seed oil.
$t_3$ = temperature of melting point of mixed fatty acids.

Then $w_1 = w_3 \frac{t_2 - t_3}{t_1 - t_2}$

$w_2 = w_3 \frac{t_3 - t_1}{t_2 - t_1}$

Inserting the values:

$w_1 = 20 \frac{23 - 30}{20 - 30} = 14$ per cent.

$w_2 = 20 \frac{23 - 20}{30 - 20} = 6$ per cent.

Or,

| | |
|---|---|
| Paraffine oil | 80 per cent. |
| Rape seed oil | 14 " |
| Cotton seed oil | 6 " |
| Total | 100 per cent. |

By synthetical work upon these proportions, with comparison of viscosities of the sample submitted with the product, the result will be not only a correct analysis, but a working formula can be given by which a manufacturer can duplicate the original oil.

## Burmah and its Oil Fields.

Centuries before the existence of the American continent was known to Europeans, the peoples of Eastern countries were gathering petroleum from the surface of the earth and utilizing it for domestic purposes, yet history proves conclusively that it was the white man who, by his inquisitiveness, discovered the true value of the fluid, and developed it into its present great commercial position. The manner of obtaining the oil in China, India and Burmah is practically the same. It is to day the same primitive method which those peoples have adhered to for a thousand years or more, and will not improve upon, no matter what their necessities may be. The Chinese, there can be no doubt, were the first to adopt a system of drilling deep wells, when seeking brine, and many of the "boreholes" in that country, which have for ages provided the inhabitants with salt, compare favorably as to depth with some of the deepest of the famous wells of Pennsylvania. The present Canadian "pole" system of drilling is nothing more nor less than a copy of that employed by the Mongolians many hundreds of years before Canadian soil was touched by the foot of the white man; but iron and steel have taken the place of the bamboo and twine, and the platform lever upon which the ancient Celestials danced their monotonous jigs has given way to the high derrick and the walking beam operated by that domesticated giant, the steam engine. But, although oil was found in India, China and many other parts of the Old World, its use was confined to the immediate vicinity of the springs, until Professor Silliman, by his discovery of the true properties of petroleum in 1854, indicated that nature, with her inscrutable bounty, had afforded to man a substitute for coal. The rush that was made for the oil fields of Pennsylvania was, if anything, greater than that for the gold fields of California, South Africa and Australia, and the news soon spread to other countries that the mysterious fluid which exuded from the earth was of great commercial value. Eastern peoples, however, move slowly, and the reports from the western world had but little effect in turning them from their plodding course. Russia, owing perhaps to her closer contact with western civilization, was the first to move, but with such slow steps that her progress was not apparent until fully a dozen years had passed after the valleys of Pennsylvania were swarming with oil hunters. It must be said that the natives of Baku and the surrounding oil territory had for ages used the oil, and as early as 1813 the Russian Government was deriving a small revenue from its sale; but it was not until E. L. Drake put down the first well near Titusville, Penn., on May 1, 1858, and obtained petroleum therefrom in the summer of 1859, that the Russian territory attracted the attention it deserved; in fact, the first practical movement for its development dates back no longer than 1872, when private enterprise was permitted to engage in the work which has now grown to such vast proportions.

There is to day no greater rivalry in the peaceful lines of commerce than that between the great western republic on the one hand, and autocratically governed Russia on the other.

Russia produces so much oil at present that it would be reasonable to suppose that she can place her oil on board ship at such a low rate that the United States could not attempt to compete with her. But such is not the case. The Russian petroleum affords but about 40 per cent. of refined oil, and the means of conveying it to the port at Batoum are still very inadequate. On the other hand, the American pipe lines connect the wells with the Atlantic seaboard, and the petroleum contains about 75 per cent. of light oil, besides being rich in paraffine, which latter product is of large commercial importance. For illuminating oil alone America could compete with Russia, even if her wells only produced one-half that of the latter.

While the two countries have been fighting for the increasing eastern trade, there has been a steady growth in the local oil fields of that part of the world, and the development of petroleum in the "uncivilized" territories has now not only passed the line of probability, but is beginning to show itself within the commercial radius in such a manner that those countries which claim both the benefits of civilization and unlimited petroleum will soon have to don all their armor and fight that most inveterate foe of monopoly—competition.

Now that petroleum has made its way so thoroughly into commercial life, the question arises, What will be the outcome of its general production throughout the earth?

In October last *Engineering* referred to the vast deposits of petroleum in Peru, and indicated that their development would have the effect of closing the South American market against Pennsylvanian oil. The American Consul at Callao, in his recent report to the Government, shows that the time is not far distant when the production of the South American fields will be more than sufficient to supply that continent, and that it can be placed on the market at such prices that will practically prohibit the sale of the northern oil within the territory. This opinion, coming as it does from an official source, will not please those who have striven so hard to keep the southern oil fields under a cloud. The drill has beaten them with facts.

The same state of affairs exists to day in Burmah, and, indeed, to a greater extent. The eastern countries are dependent at present for kerosene upon either Russia or America, although it is a well known fact that petroleum is at their very doors, and only awaits development in a practical manner. The Dutch on the Island of Sumatra have begun to develop the oil fields of Langkat, and are said to have met with very fair success. The industry is young, and, although several concessions have been given by the Dutch Government, the English capitalists have not yet made very much progress. The Dutch company which started its first well near the shore of Arn Bay in July last, has had some very satisfactory results; in fact, about 10,000 cases of 10 gallons each are said to be shipped every month for distribution among the islands in the Straits of Malacca.

In India the efforts to develop the petroleum industry, where indications of the oil were found, have not been attended by encouraging results, and it would seem that the country was either out of the line of the oil belt, or the formation in which the oil is deposited is deeper lying than the wells have been sunk to. The Indian Government has been exploring for oil in Beloochistan for some time, but after expending a large amount of money, the quest for liquid fuel has been given up as a bad job. The same is true of the oil fields of Khattan, where many borings of from 700 feet to 1,400 feet have been made without increasing in any way the small production that marked the inauguration of the work.

The Chinese wells yield but little petroleum, although great quantities of gas are obtained; and, therefore, no attempt is made to search for the oil, salt being of by far the greatest value in the eyes of Ah Sin and his cousins. The Chinese are keen in cultivating the rivalry of the great oil producing countries, and take from Russia, America and Peru just so much as suits them, and at prices that are reduced to the minimum by competition, and by the wily purchasers biding their time.

The Japanese wells produce a fair quantity of oil, but the system of getting it is no improvement upon that of the mainland. Take, for in-

stance, the wells at Kudoso, in Echigo, at present. The oil is not pumped, as it would be had the Anglo-Saxon workman anything to do with it. It is raised by buckets, which are attached to a rope passing over a wheel at the surface, and it is arranged so that one bucket is coming up while the other is going down. The buckets average about 5 gallons each, and, therefore, one man can do the hauling, as the weight against him it no more than 40 lbs. The cost of sinking wells in the eastern and western hemispheres is apt to mislead people, but when the time taken up in completing the work is considered, the extra cost is more than counterbalanced by the saving of precious hours, not to speak of days. In Japan a 300 ft. well costs about $300, and takes three months to sink. In Gallicia it would cost about $2 per foot, or $600, and take about as many weeks; but in America, the formation being suited to the cable system of drilling, they can do 300 ft. in a fortnight, and sometimes less. The Japanese oil fields also lack definiteness, which is due, no doubt, to the volcanic character of the islands.

In Burmah the oil fields are on a different basis. There the oil has not only been known to exist, but, with the aid of the most primitively constructed wells of no great depth, the natives have been able for ages to keep up a flourishing export trade with the adjacent countries.

The physical features of Burmah, and particularly those of the valley of the Irrawadi, are admirably suited for getting the oil out of the country when once taken from the wells.

What is known as British Burmah is divided into a series of valleys formed by the three ranges of mountains—the Pounglung, Pegu, and the Arracan ranges. The first range begins at the head of the Gulf of Martaban and to the east of the Sittang river, and runs in a due northerly direction along the east bank of the river for a distance of about 300 miles, when it spreads into a great ridged plateau to the eastward of Mandalay. In this great plateau lie the sources of all the tributaries of the Salween river, which marks the Siam boundary line.

The Second range, the Pegu, begins a little to the northeast of Rangoon, and also runs directly north until it is broken by the gorge of the Irrawadi river, which turns directly to the east at Sagain. It lies midway between the Irrawadi and the Sittang, and forms their eastern and western watersheds respectively. The Arracan range commences at Cape Negrais, the extreme southwestern point of the district of Pegu, and follows the coast line of the Bay of Bengal until it is lost in the intricate mass of high lands south of the Bramaputra.

The Sittang Valley is considerably narrower than that of the Irrawadi, the mountains forming it in many places almost merging, and forming the steep gorges through which the river rushes with great violence. That of the Irrawadi, in which the oil fields of Burmah are located, is broad at the southern extremity, but contracts near the town of Prome, and expands again after Yenangyoung is passed, its width being about 250 miles in the latitude of Mandalay, where it is, however, broken by small disconnected ranges of mountains of no great height.

The Irrawadi river, the source of which is still a mystery, hidden in the bosom of the Tibet mountains, is navigable for a distance of about 850 miles from the sea, and is subject to great fluctuations in level, the highest being sometimes 40 feet above the summer level during the rainy season. During this period the banks are completely covered, and the velocity of the water reaches fully 5 miles per hour in the center of the stream. It does not suffer, however, from the effects of the "bore," as in the case of the Sittang on the other side of the Pegu range. This peculiar tidal phenomenon seems to be confined to the northeastern shores of the Gulf of Martaban, and is, no doubt, due to the influence of the tide waves from the Indian Ocean upon the local currents along the Tenasserim Coast. But whatever the cause, its effects are very disastrous, and the greatest caution is necessary on the part of navigators to avoid it. The natives, however, endeavor to utilize the great carrying power of the great tidal wave—a rather risky practice—by waiting for it to pass one of the small creeks, and then pushing into the rushing water that follows the crest.

The Irrawadi river, south of Nussaoh, is divided into a great number of passages, the banks of which are scarcely raised above high water. Indeed, the delta, which is being extended seaward steadily, consists of nothing more than a series of mud flats, between which are many channels more or less navigable, the principal being the Rangoon, the Dallah and the Bassein "rivers."

It is no uncommon thing to see the plains lying between the mountain chains completely covered by water to a depth of from 1 foot to 10 feet, and when this is so, all communication between the houses is made by means of boats, and the cattle are relegated to the first floor from the roof.

The juvenile Burmans tempt the finny tribes that venture into the back yards with cunningly baited hooks which are let down from the chimney tops, and thus manage to indulge in the pastime of Isaak Walton without undergoing the discomfort of leaving their homes.

Although one would imagine that such periodical overflows would render the climate unhealthy, such is not the fact. There is, of course, a certain amount of fever at the beginning and end of the rainy season, but not more so than in districts having less claim to notoriety for moisture. The seasons are well defined—the rainy, the cold and the hot. The first begins in May and ends in October, the second extends into February, and the balance of the year is hot.

The petroleum industry, as has been remarked, is of long standing, but the Twinzas, or native well owners, have never attempted to produce the oil in any other than the primitive way common to all the far eastern countries, and therefore the quantity available for export and home consumption was infinitesimally small compared with what was left untouched in the earth. In 1854 the first attempt was made to enlarge the industry, when Mr. W. de la Rue patented a process for the manufacture of various products from the crude petroleum of Yenangyoung, and even this was carried out to a very limited degree. The cause of the delay, it seems, was mainly due to the fact that the sources of the oil supply were under the control of the king, and he was not disposed to grant any concessions for their development except under such conditions that precluded their being worked profitably. When Upper Burmah was annexed in 1876, however, the Burmah Oil Company began operations which proved highly successful, and very soon the oil extracted at Kodoung and Yenangyoung was being refined at Rangoon. The steam drill supplanted the shovel in opening up wells, but, strange to say, the latter were not drilled to anything like a proper depth. It seemed as if the first show of oil was considered sufficient, and it is only lately that the districts, known to contain vast deposits of oil, have been taken up with the view to the production of sufficient petroleum to supply the great market that surrounds the district.

One of the most actively interested people in the development of the Burmah oil fields is Mr. C. D. Aria, who some time ago sent out an oil expert to examine and report upon the district, and, if necessary, secure the drilling rights. The expert, Mr. Frazer, made a careful survey of the ground, and selected numerous blocks of land where the oil shows where pronounced. There were others in the field also seeking for good drilling sites, but, through the energy of Mr. Aria, the interests of the several syndicates have been merged, and arrangements are being made to work the rich petroleum lands in a thoroughly practical manner.

The districts wherein the best indications have been met with are in Yenangyoung (Magwe), Yenangyoung (Myingyan), Minbu, Yenankyet (Pokoko), and Padoukpen (Thayetmyo). These districts are all close to the Irrawadi river, and therefore the question of transport need scarcely be considered. Those who care to pursue the subject further are recommended to study the reports presented by Mr. Boverton Redwood, the celebrated English authority on matters petrological. That gentleman has prepared complete statistics respecting the several districts, which include analyses of the oils produced.

## The Art of Mining by Fire.

By Mr. Arthur L. Collins.

In olden times, before the invention or common use of explosives, the best method available for mining through the hardest kind of rock, such as resisted the use of hammer and wedge, was by means of fire. Nothing is more natural than that the effect of fire on rocks should have been known at a very early period; no one who has lighted a fire on rock can help noticing the rending effect of the heat. The same thing would be seen after any natural forest fire; several examples on a very extensive scale have recently come under the writer's notice in Australia where bush fires of great extent are frequent, and all the rock cropping out at surface is seen to be cracked and split over great areas. The great trouble with the fire setting seems always to have been the heat and smoke produced—the latter being often strongly sulphurous, where the ore contained pyrites or other sulphides. It is easy to see that this would have been a great obstacle, where the means of artificial ventilation were so imperfectly understood; but it applies far less at the present day. Indeed, by a proper system of ventilation with upcast and downcast shafts, it need be no more objectionable than the ventilating furnaces still used in some colleries; and at Kongsberg silver mine in Norway, the system is still used occasionally for driving levels, mainly on account of the great improvement in ventilation which it causes throughout the mine.

The writer has recently had an opportunity of seeing the process at work in this mine, and as it is perhaps the only place of importance in Europe where it still survives, a few details of the mode of working may be of interest. The process is now confined to the occasional driving of levels in hard siliceous gneiss—it having been found that the micachist and other micaceous rocks, which also occur at Kongsberg, are far less favorable for fire setting. A short piece of level is driven at first in the

ordinary manner, to get room to start the process; and wood—mainly logs of white fir and red pine, dry and split—is closely piled up so that the fire plays against the "face;" waste wood or old timbers from the mine being often piled against the freer burning fir, to concentrate the heat. When the pile is lit smoke fills the level, and the men leave it, but in two or three hours it is generally burnt out, and as soon as the men can come in the broken stone which is split off is cleared away, and all that is sufficiently loose is broken down. The fire sets stronger on the roof and sides than on the sole, so that the levels have a constant tendency to slope upwards. This can partly be prevented by better arrangement of the fuel, putting long pieces at the bottom and covering the upper part; but sometimes the sole has to be blasted. The ordinary speed of driving is from 5 feet to 20 feet per month. Prof. Helland states that fire setting kept its place as the common method at Kongsberg so long as double-handed boring, iron borers, and powder were used; but that on the introduction of single-handed boring steel borers and dynamite or other high explosives, the use of the old method rapidly died out.

In 1864 fire setting was both cheaper and quicker than the old method of blasting with powder in large holes; but on the introduction of dynamite and small holes, things were entirely reversed; not only did the new method effect a great saving in time and cost, but fire setting became actually dearer than before, owing to the increasing wages. It should be added that at Kongsberg suitable wood is very cheap—an important point, when it is remembered that about nine parts (by volume) of wood are required to one part of rock, and that much less skilled labor is employed for the fire setting—as is indeed shown by the rate of wages paid. There seems to be little reason to believe that fire setting is very unhealthy for the men employed, when care is taken to ensure efficient ventilation. No doubt the great heat developed is prejudicial; but perhaps not more so than the dynamite smoke, the constant jar to system in heating the drill, and the fine sharp dust often inhaled, incidental to the more modern process.

Attempts have been made at various times to improve the fire setting methods, by using turf at the Rammelsberg mines in the Harz, and brown coal in the tin stock works at Altenberg; but neither was successful. Better results were obtained with coke at the St. Christoph mine near Breitenbrunn in Saxony. At Felsobanya, in Hungary, the method is improved by the firewood being held in an iron framework on legs or wheels ("pregelkatze"), which concentrates the fire and improves the draught. According to Serlo, Hugon has used a small furnace, mounted on wheels, supplied with a blast to urge the flame direct on to the rock, at the Challenges mine in France. Burning small coals, this apparatus in 55 hours drove an end 4 feet wide and 6 feet high a distance of 5 feet; whilst two men with the usual explosives would only drive the same end from 5 to 6½ feet in a month. If this were done at a reasonable cost, it would be a very fine result, but as to relative economy Serlo gives no particulars.

As to the possible future of the fire-setting method, it is unlikely that it will ever again come into use to any important extent; for although it could hold its own under suitable conditions against blasting with powder, yet the modern improvement in high explosives and boring machinery, which have deprived mining through the hardest rock of all its terrors, have done away with any necessity for the old process. Yet, in exceptional cases, where machinery and skilled labor are not available, fuel cheap, and the rock very hard and siliceous—conditions which occasionally confront the mining engineer in semi-civilized countries—it would be worth while to reconsider its many advantages.

## SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, September 9, 1893.

*The Coal Strike.—Tar for Road Making.—Dinner under Gas.—A Penny-in-the-Slot.*

The coal miners' dispute, referred to last month, still continues, and more than half of the collieries throughout the country have now been closed for six weeks. If anything further was needed to illustrate the dullness that has been prevalent in the coal trade during the present season, it would be furnished by the general indifference on the part of the public. Every endeavor has been made by those interested to induce a panic, and thus lead to the sale of coal at famine prices. In some respects the thing has been overdone. The known fact that merchants and dealers have laid in very large stocks, has of itself served to neutralize any fear of absolute scarcity. So that the attempts to obtain higher prices from ordinary consumers have for the most part fallen flat. In many branches of manufacturing industry it is strikingly evident that the owners prefer stopping altogether to paying any large advance in price. Another cause that has tended to keep the balance even has been the fact that the low prices offered earlier in the year, together with the unsettled state of the coal market that has lately prevailed, induced all who were in a position to do so to lay in their next winter's requirements. So that not only householders, but factory owners also, have in many cases stocked sufficient fuel to carry them well over Christmas. Under such circumstances, the pits remaining at work in Durham, South Wales and Scotland appear quite equal to meeting the present demand, and gas companies have no difficulty in placing orders for coal at prices something lower than they have lately been accustomed to pay. Of course, the effects of nearly half a million men remaining idle for several weeks, are certain to be attended with immediate disaster to those intimately connected with the colliery districts, and eventually to spread through every class of the community. In the general depression the gas companies must with others bear their share. Beyond this, however, they are not likely to be affected by the present state of affairs.

In these days of cheap tar it is remarkable that little if any attention is devoted to its capabilities, with a view of extending the demand for it. In one direction at least these have never been properly cultivated, and that is the use of tar for road making. The steam roller of 10 or 15 tons weight has now become an indispensable portion of the road surveyor's plant in every town that can afford to buy one, and small communities meet this difficulty by hiring. The need for some matrix or concreting material must be apparent to anyone who has watched these machines at work. Where indifferent or mixed material is used this is supplied to some extent by the crushing of the softer portions. But surely a plastic material would answer that purpose better, and when we remember that so long as water can penetrate through, the road will be liable to injury from the frosts and thaws that are so prevalent in this country during the winter, it is equally evident that the conversion of the whole crust into a solid, homogeneous and waterproof mass will be attended with a great increase of durability.

Perhaps gas engineers themselves are somewhat to blame for the fact that such a useful material as tar is so seldom applied for this purpose, seeing there are many gas works where not a square yard of properly laid tar asphalt is to be found on the place, and still more where tar is entirely absent from the roadways. Yet in every town the gas people are continually opening the roads and pathways in all parts of the town, and have it in their power to leave a good sample of tar pavement or roadway in almost every part of their district. It is rather a reflection upon them that outsiders are left to discover the best ways of carrying out the preparation and laying of this material, with the usual consequence that careless workmanship or unskilled supervision has given the whole thing a bad name.

A meeting of the Municipal Surveyors was recently held at Harrowgate, and in the course of a very able description of the various works under his charge, the Borough Engineer of that town referred to the four miles of tar macadam roadway included in it. This had attracted attention in other quarters, and he had lately received inquiries about it. He therefore thought that some account of the way in which it was prepared and laid might be interesting to his hearers, and proceeded to give such full details that his remarks may be referred to with advantage by all interested in this matter. The cost is about 2s. per square yard, including all expenses, and the durability is satisfactory. An important feature is the selection of good, hard stone, the thorough displacement of moisture from the same by exposure to a sufficient degree of heat, and the thorough incorporation with the proper proportion of tar whilst still hot. At Harrowgate the refuse ashes collected from the dwelling houses in the town are screened to remove dust, and then utilized for this purpose. The bulk of the material is prepared in a coarse state, and the finer top dressing is made separately. A sufficient quantity of Derbyshire limestone is broken to 2½ in gauge, and then spread in layers 6 feet wide and 15 inches or so thick upon dry ground. A fire is lit upon it with wood and ashes, and the whole turned and well mixed. When thoroughly dry, and before it can cool, the material is spread upon an iron plate and thoroughly mixed with tar. It is then stacked ready for use, and is considered to be much improved by storing for a few months. The surface dressing is prepared by laying a bed of ashes first, spreading a layer of chippings that have passed a ¾ inch mesh upon it, covering the whole with ashes and allowing the mass to burn for at least three days. A solid bedding having been prepared, a layer of material about 3 inches thick is put down and rolled with a steam roller. The surface is then covered with dry chippings and again rolled. A thin layer of surface dressing is then added and rolled, first by itself,

and subsequently after sprinkling with dry chippings. The edges next the gutters are trimmed and beaten with an iron beater. The method of laying sidewalks is very similar, except that smaller material is used in each case, and a hand in place of a steam roller. White spar chippings are used for the finishing of the walks, and gives them a good appearance. In the course of a discussion following the paper, several interesting practical hints were given, from which it is evident that failure in making good, durable work with tar is due either to soft stone, bad mixing, or insufficient drying before adding the tar.

The temporary utilization of a gasholder as a banqueting hall, before starting upon its legitimate sphere of usefulness, is not a new idea in connection with the inauguration of gas undertakings. But a dinner under a gasholder that is actually in use is by no means such a common occurrence, as it would be impracticable under the ordinary modes of construction. Over 100 guests were lately entertained under such circumstances by the engineers of the Danish Gas Company, near Copenhagen, in Denmark.

The gasholder and tank were constructed on the Intze system. Under this plan, which finds a good deal of favor on the Continent, the tank is constructed of iron and stands above ground, and the bottom, instead of being flat, consists of a large hemispherical dome. It occupies a similar position, in fact, to the "dumpling" in an excavated tank. By this means a large covered area is inclosed under the dome, and is available for use as stores or even workshops. It was such a space, appropriately decorated and brilliantly lighted by Siemens regenerative gas lamps, that was used as a dining room on the present occasion, and gave satis faction to the guests, with the exception of one or two nervous ones who evidently preferred a dining hall of the orthodox character. The dinner was given in honor of the commencement of a supply of cheap gas for fuel and cooking purposes. The sales of gas for such uses have been large, perhaps the largest in the world, for the Danish Gas Com pany, who supply several towns in Denmark, have more than one dis trict in which the day exceeds the night consumption. In the district now about to be supplied the demand for purposes other than lighting is so great that it has been thought advisable to supply a cheap gas of only 12 candle quality. The results of this enterprise will be looked for with much interest.

The system of prepayment meters, more popularly known as "a penny-in-the-slot," is gradually but surely making its way as a means of supplying gas to the poorer classes and to those who live from hand to mouth, and therefore cut a poor figure as quarterly customers. In several instances the system has been extended to include the cost of gasfittings, which of course would be a serious objection amongst that class. So that the occupier of a tenement not at present piped for gas, on application at the gas office is provided with a service pipe, automatic meter, two or three plain fittings, and perhaps a small gas boiling stove, free of expense. To cover this extra cost an additional charge is put upon the gas. The whole expense is not great, as a set of fittings as above indicated can be put in for £2 or less, including labor. An annual payment of 5 shillings would represent a fair return for interest and depreciation. Then if the average annual consumption of gas is 6,000 cubic feet, an extra charge of 1d. per 100 cubic feet will cover it. If the regular selling price is 3s. 4d. per 1,000—*i. e.*, 4d. per 100—then the meter is set to pass 20 cubic feet for each penny inserted, which is equal to 5d. per 100. Some take into consideration the avoidance of bad debts, and the prompt payment, and fix the loading at a little less than a fair charge for the fittings. To meet the objection that a user of more than the average quantity would pay too much, some have introduced the plan of allowing a rebate on extra consumption above the quantity figured on. Thus, in the case above instanced, a user of 9,000 cubic feet per annum would be entitled to a rebate of 10d. per 1,000 on (9 — 6 =) 3,000 cubic feet.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. N. G. HOCK has been appointed Superintendent of the Belleville (Ills.) Gas Light and Coke Company. He will also have charge of the Company's electric lighting plant.

MR. WILLIAM S. ESSICK has resigned the position of President to the Keystone Meter Company, of Royersford, Pa., for the purpose of engaging in business on his own account. This action on his part involved a reorganization of the Keystone Company's board of officers, and at an election held with that object in view the following executive management was chosen: President, Mr. John H. Mansur—formerly Vice-President; Vice-President, Mr. John M. Shade; Secretary, Mr. Warren B. Mansur; Treasurer, Mr. George Lewin.

MR. E. E. DENNISON, President of the Chartiers Valley Natural Gas Company, of Pennsylvania, died at his home in Philadelphia on September 13th. Deceased, who was in his 46th year, was a member of the Philadelphia banking firm of E. W. Clark & Co.

THE Trades League, of Philadelphia, while favoring the movement inaugurated by Director Windrim for cheaper gas in that city, are evidently of the opinion that the Director does not ask for a rate sufficiently low. In any event, at a recent meeting they adopted a resolution placing the selling price of gas at $1 per 1,000.

THE residents of Westwood, N. J., are agitating the project of constructing a gas works at that point. The place is on the line of the New Jersey and New York Railroad, some 8 miles north of Hackensack, and is quite a compactly built, handsome town. A gas works here ought to prove a profitable enterprise, for it could be so located as to supply the outlying and adjoining boroughs of Oradell, Etna, Hillsdale, Woodcliff, etc.

"A. T. J.," WRITING from St. Louis, Mo., under date of the 15th inst., says: "I read your reference to the proposed consolidation of the Municipal Electric Lighting and Power, the St. Louis Electric Light and Power, the Missouri Electric Light and Power, and the Missouri Illuminating Companies, the named concerns to take on the title of the Edison Illuminating Company. This scheme has in reality been accomplished, and the only rival the company has in the supply of electric lighting in the city is the Laclede Power Company."

THE following table of existing contracts for public arc lighting in the named cities will be of interest:

| City. | Population. | No. Lamps. | Hours of Burning. | Cost per Lamp per Annum. |
|---|---|---|---|---|
| St. Louis, Mo..... | 500,000 | 2,070 | 3,650 | $91 25 |
| Springfield, Mo.... | 25,000 | 75 | 3,630 | 114 00 |
| Buffalo, N. Y..... | 300,000 | 2,000 | 4,000 | 127 25 |
| Tiffin, O..... | 12,000 | 125 | 3,600 | 88 00 |
| Mansfield, O..... | 15,000 | 115 | 2,787 | 100 00 |
| Rochester, N. Y... | 150,000 | 1,532 | 3,650 | 96 25 |
| Oshkosh, Wis..... | 25,000 | 217 | 1,300 | 70 00 |
| Memphis, Tenn.... | 75,000 | 115 | 3,400 | 120 00 |
| Nashville, Tenn... | 90,000 | 250 | 3,400 | 94 90 |
| Scranton, Pa..... | 90,000 | 400 | 3,650 | 91 25 |
| Pittsburgh, Pa..... | 300,000 | 1,300 | 3,650 | 96 00 |
| Philadelphia, Pa... | 1,250,000 | 1,400 | 4,000 | 161 50 |
| Norwalk, O..... | 7,500 | ? | 1,250 | 58 10 |
| Massillon, O..... | 10,000 | 110 | 1,300 | 70 00 |
| Canton, O..... | 27,000 | 115 | 2,200 | 70 00 |
| Eau Claire, Wis... | 18,000 | 79 | 4,000 | 110 00 |
| Madison, Wis..... | 14,000 | 78 | 2,000 | 90 00 |
| Binghamton, N. Y. | 35.000 | 251 | 4,000 | 131 40 |
| Brooklyn, N. Y... | 1,000,000 | 1,222 | 3,833 | 182 50 |
| Poughkeepsie, N. Y. | 24,000 | 233 | 3,711 | 113 00 |
| Elmira, N. Y..... | 37,000 | 208 | 3,600 | 102 20 |
| Syracuse, N. Y.... | 100,000 | 550 | 3,650 | 109 50 |
| Birmingham, Ala.. | 37,000 | 160 | 3,650 | 108 00 |
| Little Rock, Ark... | 26,000 | 136 | 2,200 | 69 83 |
| Bridgeport, Conn.. | 50,000 | 208 | 4,000 | 127 75 |

AT a meeting of the Directors of the Eastport (Me.) Gas and Electric Light Company, held about a fortnight ago, it was decided to discontinue the manufacture of gas on January 1st, 1894.

A CORRESPONDENT at Lynn, Mass., forwards the following description of the new station of the Lynn Gas and Electric Company: "The Lynn Gas and Electric Company is contemplating complacently the completion of its new station, located on a plot to the east of the present gas works. From almost either side of the harbor of Massachusetts Bay this new power station can be seen, making with its tall stack a notable landmark. It is of brick, having three bays extending nearly north and south, and the main entrance in the western side of the block. It covers in plan a space of ground 168 by 157 feet. The height is one story and a half above a basement, and each gable has a monitor roof, the western and middle one lighted by 72 windows each, the eastern, which is a little lower than the other two, upon a slightly lower roof, being simply a blinded hood for the escape of smoke and dust. The taller gables are 54 feet from the ground to apex of monitor roof. Above these, from the eastern bay, rises the tall stack, 150 feet to the cap, 17 feet diameter at the base, and having an 8-foot flue. It is cylindrical in section, and forms a companion landmark to that of the Lynn and Bos-

ton stack further up the harbor. In the western bay is the dynamo room; next comes the engine room, and in the eastern section the boilers are now going into position. Some of the machinery will be moved from the Pleasant street station, which plant, for a time, will be held in reserve. The station is arranged for a capacity of from 3,000 to 5,000 horse power, which can operate at a rough estimate 1,000 arc and from 25,000 to 30,000 incandescent lamps. The shafting was installed by Messrs. H. N. Bates & Co., of Boston. From an experience of several years the Company has been able to most carefully estimate the furnishing and equipment necessary to supply the demands of the city, and the apparatus selected have been only those of known and tried merit, specially adapted to the needs of Lynn. The engines are compound condensing of the most modern and improved type. There will be three at once put in active operation, and ultimately five, each of from 600 to 1,000 horse power. These are furnished by the E. P. Allis Company, of Milwaukee, Wis., and are of the Corliss type, and the condensers are by the Wherter Condenser Company, of New York. The boilers are of steel, and are considered very heavy, strong and durable. Both engines and boilers are so arranged that any one engine can be driven by any one boiler, and the steam pipes being duplicated throughout the entire system, it would seem that nothing has been neglected to insure absolutely against loss of time by accident. It has been the express intention of the Company to thus guard against mishaps, and in the matters of reliability and economy to obtain, if possible, the maximum degree. The coal used is obtained at first cost, the wharf being less than 100 feet from the boilers; and the use of salt water in the condensers is another very important saving, the condenser being the most economical type of engine built. Most of the electrical machinery will come from the Pleasant street station, and the present force will be retained, about 12 men being required to operate. The new station is considered to be up to date in every particular, and one of the best in the Eastern part of the country. The engineering details were developed by the Company's Superintendent, Mr. Charles F. Prichard, and the general design, after having been evolved by the Company, was placed in the hands of Dean and Main, engineers and architects, of Boston. The boiler house is fireproof, and the other two practically so. The piping will probably be done by the Company's men, thus securing a thorough result at moderate expense. The roof framing, of iron truss work, was furnished by the Berlin Iron Bridge Company, of East Berlin, Conn., the brickwork was by E. E. Strout, the carpentering by C. C. Blanchard, the slate roofing by Burns & Lee, and the foundation and excavating by H. Scott Tuttle. The Company expects to occupy the new structure very soon."

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At the annual meeting of the shareholders in the Worcester (Mass.) Gas Light Company, the following Directors were elected: Messrs. Charles D. Lamson, A. G. Bullock, Waldo Lincoln, Joseph E. Davis, F. H. Dewey, Joseph H. Clarke and Joseph Sargent. The Directors named Mr. Lamson for President, and Mr. James P. Hamilton was elected Treasurer and Clerk.

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The Westerly (R. I.) Gas and Electric Light Company is extending its wires to the adjoining village of White Rock.

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The plant of the Pearson type which is being put up at the Citizens works, Brooklyn, N. Y., is merely for experimental purposes.

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The Chicago *Times* says that on Monday last the City Council received from the Corporation Council a suggestion as to how the Suburban Gas Company of the Lake View district may be compelled to obey the provisions of its ordinance and, when ordered by the Commissioner of Public Works, lay mains in streets that are to be paved and improved before the improvement is begun. In 1844 the Trustees of the town of Lake View granted a franchise to the Suburban Gas Company, a provision of which was that when a street was to be improved the Trustees might order the Company to lay mains and services in the street before the improvement was made. It is not yet certain that any penalty for the violation of this order is contained in the ordinance. The Company, after annexation, when the ordinance was binding in Chicago, refused to obey such orders from the Department of Public Works; thereupon the Council Committee on Gas, Oil and Electric Lights proposed an order revoking the franchise. This order was never acted upon, however, and now, the Company having refused to lay pipes at the instance of Councilmanic direction, the Corporation Counsel has been appealed to for an opinion as to whether the authorities have the right to revoke the franchise. The Corporation Counsel in his opinion believes the Council cannot rescind the franchise, but does believe that the necessary legislation to compel the Company to act in the desired manner can be enacted.

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Manager T. D. Miller, of the Dallas (Texas) Gas Company, is meeting with marked success in the placing of Welsbach burners in that city. In connection with the rumored discovery of serviceable stores of natural gas in his locality, Manager Miller has the following to say: "About three months ago H. R. Hearne, of Robertson county, came to my office and told me that he had natural gas on his plantation and desired to utilize it. I visited his place, four miles east of Hearne, in the Brazos bottom, and stored samples of the same in bags which I brought to my office and tested. I found the gas was odorless, with splendid heating qualities, but when I attempted to burn it from an ordinary burner the light was unsatisfactory, giving only a pale, yellow flame. I then tested it through a Welsbach burner and it gave out a beautiful white light, soft and mellow, the nearest approach to daylight possible. I then undertook to devise the necessary apparatus for separating the gas from the water—the water is saturated with the gas and the latter, of course, escapes on coming to the surface. When lighted with a match it blazes up at the mouth of the pipe and burns a foot or two down on the stream of water; one would think that the water was actually burning. I devised and had constructed here three apparatuses, to be used at three wells, to separate and accumulate the gas, and from these pipes carry the gas to the storage holder, of about 500 feet, near the residence. The three wells supply about 1,000 cubic feet of gas in 24 hours, 50 per cent. of which is furnished by a new well recently sunk in the yard. This new well was undertaken principally for gas, and is a 3 inch well, about 285 feet deep. The flow of water from this well is about a barrel a minute. The installation was completed yesterday afternoon (Sept. 13) and last evening the residence was illuminated with 23 Welsbach incandescent gas burners. The supper was cooked on a gas range, and I enjoyed a hot bath, the water being heated instantaneously by the natural gas. Mr. Hearne is not only the pioneer in utilizing natural gas in Texas, but he was the first one to obtain artesian water in middle and southern Texas. He has about 40 of these wells on his plantations. There are many places in Texas that have natural gas and it should be utilized."

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The hearing before the Board of Gas and Electric Light Commissioners on the petition of the city of Chelsea, Mass., for a reduction in the price of gas to $1.50 per 1,000, and for an improvement in candle power, was commenced in the Council Chamber of the City Hall on the 15th inst. Commissioners McDonald and Barker were present. City Solicitor David E. Gould appeared for the petitioners and the Company was represented by the Hon. David F. Kimball. Quite a gathering of the citizens witnessed the proceedings. Mayor Converse was first examined. He said there had been many complaints made to him in regard to the price and quality of the gas supplied, the allegation being frequent that the Company charged more for a poorer quality of gas than was distributed in other cities. He saw no reason why the Company could not furnish gas and electricity as low as in other cities of the State. The Mayor was followed by Mr. Nelson, who asserted there was general dissatisfaction among the storekeepers on Broadway, both as to price and quality of the light supplied. The Company, since the petition went in, had reduced the price on incandescent lights to 1 cent per hour, which was satisfactory. The gas pressure at times was very light. He thought if Boston got gas for $1 per 1,000 Chelsea ought to have it for $1.50. The price now is $2, with a discount, for prompt payment in 15 days, of 15 per cent. Other witnesses who testified on about the same line were Wm. Pinkoffski and G. W. Luker. Mr. A. M. Merritt thought the price ought not to exceed $1.50, but he admitted that he had no reason to find fault with the quality of the light. Mr. Wm. G. Peck, President of the Company, said he did not know the cost in the holder to the Company of its gas. He had been connected with the Company since 1880. Colonel Geo. W. Moses, Treasurer of the Company for the past 15 years, stated that the Company had lost $600 on the electric light plant this year as compared with 1892, and the profits on both gas and electricity had been less. Not long since the Company had lost considerable gas from a leak in the main pipe on Second street, which leak was caused by the carelessness of the contractors who were putting in a sewer through that thoroughfare for the city. The Company was contemplating laying new pipes from Third street to Bellingham, which pipes would obviate the lack of pressure complained of by the Broadway storekeepers. The largest semi annual dividend paid since 1878 was 3 per cent. On being asked to state the cost of gas in the holder, Mr. Moses declined to answer by advise of counsel. City Solicitor Gould insisted on an answer, and called for a ruling. The Board retired to consider the question, and the Chairman subsequently reported

the Commissioners had no power to compel the witness to answer the query. The hearing was then adjourned.

THE Commission in charge of the construction of the State Asylum for the Chronic Insane, at Wernersville, Pa., ask for proposals for the placing of an electric light plant. The plans can be seen at the office of the engineers, Messrs. M. R. Muckle, Jr., & Co., 210 Drexel Building, Philadelphia. Proposals are to be submitted to Mr. John M. Reynolds. Secretary of the Commission, 1001 Chestnut street, Philadelphia, and the competition will end at noon, October 2d.

MESSRS. HENRY C. REW, Wilson A. McClary, Chas. D. Hauk and E. E. Morrell, have filed papers incorporating the City and County Gas Company, of Chicago. It is capitalized in $30,000,000.

THE capital stock of the Edison Electric Light Company, of Kansas City, Mo., has been increased to $280,000 from $225,000.

ACCORDING to the Toledo (O.) *Commercial*, on September 14th the Committee on Gas and Lighting of City Councils held a session for the purpose of considering the matter of entering into a contract for the public lighting. The Western Electric Company's bid was for a 5 year contract, at the rate of $100 per lamp per annum, for arcs of 2,000-candle power. The Toledo Gas Light and Coke Company, on the basis of a 5 year contract, agreed to supply gas, of 18 candle power, to any desired number of lamps, at the rate of $1.05 per 1,000 cubic feet. If a 10-year contract were awarded the Company would furnish gas at $1 per 1,000. Before any action was taken on the proposition, Mr. Lamb, who had written to the authorities of several cities inquiring as to the price at which gas was sold in the respective localities, said he had obtained the following figures: Cleveland paid 80 cents per 1,000, with a rebate of 6½ per cent.; Dayton, $1.10, with 10 cents off for prompt payment; Cincinnati, $1.10 gross, or $1 net for gas used in public buildings, and 98½ cents per 1,000 for gas used in the street lamps. At Buffalo, N. Y., the rates were $1.20 gross or $1 net; at Detroit, Mich., the rate was 90 cents. Mr. Osborne read a letter from Secretary Germaine, of the local Manufacturers' Association, in which it was held that arc lighting at Toledo ought not to cost over $60 per lamp per annum. He said the arc rate at Cincinnati was $84, while at St. Louis the public arc lighting cost only $74.95 per lamp. To a question by Mr. Hake, Mr. Faben replied that he did not know whether the Gas Company would stand by its bid if the awarding of the contract was postponed. Mr. Osborne said that the Western Electric Company had not bid in accordance with the terms of the advertisement, which called for bids for one, two, three, four or five years. The Company bid only for five years. The Company's representative claimed that Mr. Osborne's statements were not in accordance with the wording of the advertisement. Quite a wordy wrangle then ensued, which finally terminated in the adoption of a resolution (offered by Mr. Hake) to lay the entire matter over for two weeks.

THE new station for the Lynn (Mass.) Gas and Electric Company will be built by the Berlin Iron Bridge Company, of East Berlin, Conn. The dynamo room is 58 feet in width by 157 feet in length, the whole space being controlled by a travelling crane. The boiler room will be 48 feet in width and the same length as the dynamo room. The roof of this building will be entirely of iron constructed under the well known patent of the Bridge Company. The Berlin Company's patent "Anti Condensation Corrugated Iron Roofing" seems in great favor with electric light and power companies as it is fireproof, and at the same time the Company guarantees there will be no drip or condensation on the underside of the corrugated iron. It is said this is the only fireproof roof made where this condition can be guaranteed.

THE following from the Philadelphia *Item* of recent date is rather interesting: "That gas can be furnished to the consumer for $1 per 1,000 cubic feet is declared by well informed men to be as practicable as the scheme to make the price $1.25. With ordinary business methods and the proper exercise of economy in the Bureau, the city can furnish an even better quality of gas at the demanded rate. Councilman Charles K. Smith, Chairman of the Joint Committee on Gas, commenting on Director Windrim's statement that a private corporation can make gas more cheaply than the city made this remark: 'You know, and I know, and everybody who knows anything at all of politics knows that the city or any municipality cannot manufacture gas as cheaply as an outside corporation. And Councils will not vote for a reduction below the proposed rate of $1.25 per 1,000. Every politician and every Councilman has friends who want positions in the gas works, and as a result the cost for labor is far more than it would be in a private corporation. You can't make these men work, and, in fact, the boss at each gas works is a ward leader who owes his position to the friendship and votes of the men under him. A meeting of the Gas Committee to consider the proposed reduction will be held shortly, and several other questions will be considered, among them the purchase of the Twenty-fifth Ward Works and the improvement of the Point Breeze Works. I think the rate will be made $1.25 per 1,000, in accordance with Director Windrim's recommendation, and that will still leave the city a margin of profit.' When Agent Addis, of the Citizens Municipal Association, was questioned on the subject, he said that neither Director Windrim nor Mayor Stuart had got to the bottom of the question by fixing the rate at $1.25. 'The only way to supply consumers with good gas at a fair price,' he said, 'is to take the Bureau of Gas out of politics and introduce ordinary business methods in place of patronage. At present a place in the gas works is given as a reward for services rendered the party, and the effect of the system is seen in the bad methods in vogue in the Gas and Water Departments. Mayor Stuart's suggestion that the city departments pay for the gas they use is a good one, tending to check the extravagant waste that is going on. In the annual report of the Executive Committee of the Citizens Municipal Association the danger threatening the city in the ownership by an outside corporation of a portion of the gas plant was pointed out.'"

THE 30 days allowed the Detroit Gas Company in which to accept or reject the ordinance passed by the City Council, fixing the price of illuminating gas at 80 cents per 1,000 cubic feet, expired at noon of the 15th inst. Directors of the Company representing all the Companies involved in the consolidation met at the main office on the forenoon of the 15th inst. and decided, after a very lengthy discussion, to notify the Council that the Company cannot accept the ordinance, on the ground that it is simply impossible to supply gas at the price named.

IT is hinted that the Fort Wayne Electric Company will elect to sever its relations with the General Electric Company.

THE Beverly (Mass.) Gas and Electric Light Company has made greater extensions to its main system the past year than the total work in the same direction for the past ten years.

## Drop Forgings at the Fair.

The *Scientific American*, in a recent note on some of the exhibits at the World's Fair, said that, aside from the general commercial interest which attaches to an international exhibit, the displays that are distinctive by virtue of their arrangement and class leave enduring impressions. A large wall space in Section C, of Boiler House extension, Machinery Hall, has made for J. H. Williams & Co., Brooklyn, N. Y., an exceptional place for the display of drop forgings. Looking from the main floor through arched ways leading to the extension, this exhibit, mounted on a highly polished selected sycamore board, 16×22 feet, immediately arrests the attention of sightseers and invites a closer inspection. In a central position is a splendidly executed water color illustrating the interior of one of the best and most completely equipped forges in the country. Here, too, in this painting, is partially accomplished the illustration of methods scarcely known to the uninitiated. Drop forging has become the commercial definition of this art; but if we said "blacksmithing by machinery," it would be a literal description of the product, and greatly aid an interested public in comprehending the advanced methods in this line of manufacture. In addition to the illustration of a forge equipment, J. H. Williams & Co. have not, as far as it seemed practicable, overlooked the means necessary to further develop interest in an industry so important and still so young. To this end, and in addition to the wall exhibit, will be found dies, showing the impress of different articles and the forgings themselves in various stages of finish. A little study of the various forgings in any of the four artistically arranged panels devoted to this department of their wares suggests at once how it has been possible to manufacture the peerless and up-to-date American bicycle. Very much of the enviable reputation of this country for its unequaled sewing machines, guns and general small firearms, and, indeed, of all first class machinery, is largely attributable to uniformly excellent drop forgings of a class supplied by this firm.

The display of Brock's chain wrenches, engineers' wrenches, lathe dogs, collars, machine handles, etc., their staple articles of manufacture, well illustrates the rapid advances made in this age of improved tools and machinery. The engineers of the Edw. P. Allis, Frazer & Chalmers, and Russell & Co.'s engines, are showing with especial pride smaller boards equipped with this company's engineers' wrenches.

## The Market for Gas Securities.

The market was uncertain and inclined to weakness since the time of last writing, Consolidated being quoted to-day (Friday) at 127¾ to 128¼. Some fair trading as to volume was reported for the week in these shares. Other city shares show no change. The Brooklyn situation is complicated by the promised war of rates, and about every Company in the city seems to be impressed with the belief that laying parallel pipe lines is a sign of strength and aggressiveness. Shares are all weak and lower. Chicago gas is quoted at 58½ to 58⅝ ex. the scrip dividend of 1½ per cent. Offers of 1½ per cent. cash for the scrip have been made on the street. Bay State is reported at 19 to 20, and Baltimore Consolidated is a shade easier, at 56⅝ to 56¾. The consolidated bonds of the Detroit Gas Company are bid for at 27½. Since these bonds were listed on the Exchange, the range has been from 85, on July 6th, to a minimum of 15, about three weeks ago. There were sold at auction recently 200 Citizens, of Brooklyn, at 53. Laclede common is dull, at 14 to 15½. The Providence (R. I.) Company pays a dividend of $1 per share to-morrow.

## Gas Stocks.

**Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,**

16 Wall St., New York City.

September 25.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

| | Capital. | Par. | Bid | Asked |
|---|---|---|---|---|
| Consolidated | $35,430,000 | 100 | 127¾ | 128¼ |
| Central | 500,000 | 50 | 90 | 95 |
| " Scrip | 220,000 | — | — | 100 |
| Equitable | 4,000,000 | 100 | 155 | 160 |
| " Bonds | 1,000,000 | — | 106 | 108 |
| Harlem, Bonds | 170,000 | — | — | — |
| Metropolitan, Bonds | 658,000 | — | 110 | 115 |
| Mutual | 3,500,000 | 100 | — | 135 |
| " Bonds | 1,500,000 | — | 100 | 102 |
| Municipal, Bonds | 750,000 | | — | — |
| Northern | | 50 | — | — |
| " Bonds | 150,000 | — | — | 100 |
| Richmond Co., S. I. | 346,000 | 50 | — | — |
| " Bonds | 20,000 | — | — | — |
| Standard Gas Co— | | | | |
| Common Stock | 5,000,000 | 100 | — | 40 |
| Preferred | 5,000,000 | 100 | — | 80 |
| Yonkers | | 50 | 112 | — |
| Gas Co's of Brooklyn. | | | | |
| Brooklyn | 2,000,000 | 25 | — | 110 |
| Citizens | 1,200,000 | 20 | 50 | — |
| " S. F. Bonds | 320,000 | 1000 | — | 103 |
| Equity Gas Light Co | 2,000,000 | 100 | — | — |
| Bonds | 1,000,000 | — | — | — |
| Fulton Municipal | 3,000,000 | 100 | — | 120 |
| " Bonds | 300,000 | | 102 | — |
| Peoples | 1,000,000 | 10 | — | 90 |
| " Bonds (7's) | 368,000 | — | 100 | — |
| " " (6's) | 94,000 | — | 100 | — |
| Metropolitan | 870,000 | 100 | — | 120 |
| " Bonds (5's) | 70,000 | — | 100 | — |
| Nassau | 1,000,000 | 25 | — | 150 |
| " Ctfs | 700,000 | 1000 | 99 | 100 |
| Williamsburgh | 1,000,000 | 50 | 130 | — |
| " Bonds | 1,000,000 | — | 107 | 110 |
| Out of Town Gas Companies. | | | | |
| Boston United Gas Co.— | | | | |
| 1s Series S.F. Trust | 7,000,000 | 1000 | — | 60 |
| 2d " " " | 3,000,000 | 1000 | 40 | — |
| Bay State Gas Co.— | | | | |
| Stock | 5,000,000 | 50 | 19 | 20 |
| Income Bonds | 2,000,000 | 1000 | 40 | — |
| Buffalo Mutual, N. Y. | 750,000 | 100 | 110 | — |
| " Bonds | 200,000 | 1000 | 95 | 100 |
| Citizens, Newark | 1,000,000 | 50 | 155 | 160 |

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## Proposals for Coal Tar.

TONAWANDA GAS LIGHT CO.,
TONAWANDA, N. Y., Sept. 15, 1893.

Sealed proposa's will be received, until Oct. 1, 1893, for our output of Coal Tar for ensuing year, in barrels, averaging 50 gallons to the barrel; f.o.b. cars here. Output about 700 barrels.

TONAWANDA GAS LIGHT CO.,
955-1 Tonawanda, N. Y.

## DIVIDEND NOTICE.

STANDARD GAS LIGHT CO. OF THE CITY OF NEW YORK,
71 BROADWAY, NEW YORK, Sept. 13, 1893.

At a meeting of the Board of Directors of the Standard Gas Light Company, held this day, a dividend of one (1) per cent. was declared on the Preferred Stock, payable October 2, 1893.

Transfer books will close Monday, September 25, at 3 o'clock P.M., and reopen Tuesday, October 3, at 10 o'clock A.M.

954-3 FERDINAND McKEIGE, Secretary.

## SITUATION WANTED

**As Superintendent of a Gas Works**

by a man thoroughly posted in all branches of the business, including construction work. For ten years past has had full charge of a plant sending out 12,000,000 feet per year, but wishes to make a change. References given. Address

953-3 "W. C.," care this Journal.

## Position Wanted

**As Superintendent or Manager of a Gas or Combination Plant**

by an experienced and reliable party. Good references. Address "HOLDON,"

952-4 Care this Journal.

## FOR SALE, CHEAP,

**Second-Hand Exhauster,** capacity, 100,000 cubic feet per day; 8-inch connections.

**One-Horse Power Otto Gas Engine.**

**One Set of Purifying Boxes,** 8 ft. by 8 ft. by 3 ft. 8-inch outlets and inlets.

All in good condition. Address YOUNGSTOWN GAS CO.,
954-4 Youngstown, Ohio.

## FOR SALE,

**Two Ten-Inch Dry Center Seals,**
in good condition, and one
**Small Multitubular Condenser,**
4 ft. diameter and 14 ft high.

For particulars inquire of FRED. BREDEL, C.E.,
929-tf 118 Farwell Ave., Milwaukee, Wis.

## Valuable Gas Interest For Sale.

The undersigned will sell, to the extent of $20,000 to $50,000, in sums to suit purchaser, an interest in a growing gas business now netting 8 per cent.; increase this year will give net earnings of over 12 per cent. Money wanted for extensions to cover valuable territory. A magnificent opening for a party desiring a permanent occupation and investment in one of the most pleasant residence locations in California. Banks and business firms as references. Address for particulars and statement,

LOS ANGELES SAFE DEPOSIT AND TRUST CO.,
Stimson Block, corner Third and Spring Streets.
954-tf Los Angeles, California.

**Utilize Your Gas Liquor.**
NO EXTRA LABOR OR OPERATING EXPENSES.
**Ammonia Concentrator.**
Not Expensive. Write to
STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

## FOR SALE,

**One 30-H.P. Otto Gas Engine**

Good as new; only used six weeks. Inquire of

CHARLESTON GAS AND ELECTRIC CO.,
952-4 Charleston, W. Va.

## For Sale.

**Ironwork for Two Benches of 3's and One Bench of 5's, Complete.**

For particulars inquire of THE WINDSOR GAS CO.,
951-5 Windsor, Ont.

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## LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

## VALVES,

Double and Single Gate, ¾ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

SEND FOR CIRCULAR.

ALSO,

**Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.**

OFFICE AND WORKS:

**938 to 954 River St., & 67 to 83 Vail Av., TROY, N. Y.**

## BINDER for the JOURNAL.

STRONG.
DURABLE.
LIGHT.
SIMPLE
CHEAP.
HANDSOME.
Price, $1.

**A.M. Callender & Co.,**
32 Pine st.,
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**Mechanical Engineer,**

816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors,
Governor Gas Burners,
Gas Cocks and Fittings.

In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters.* The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

## Gas Light Companies Can Make Money

by selling our Improved Gas Engines, as well as by the consequent increase in the amount of Gas customers will use. Our Engine is declared by experts to be

"A MARVEL OF SIMPLICITY AND POWER!"

It has absolutely no Springs, no Cog Gears, no Stuffing Boxes, no Valve Stems or Guides, and in fact **No Complications,** yet every part is complete and positive in action and easily handled by the inexperienced. Our Engine entails no Boiler, no Fire, no Engineer, no License, and no Danger. We invite a call or correspondence.

SAFETY VAPOR ENGINE CO., 16 Murray St., N. Y.

## CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

**Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.**

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## To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

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**Use Only**

## THE GOVERNMENT WATERPROOF PAINT.

**Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.**

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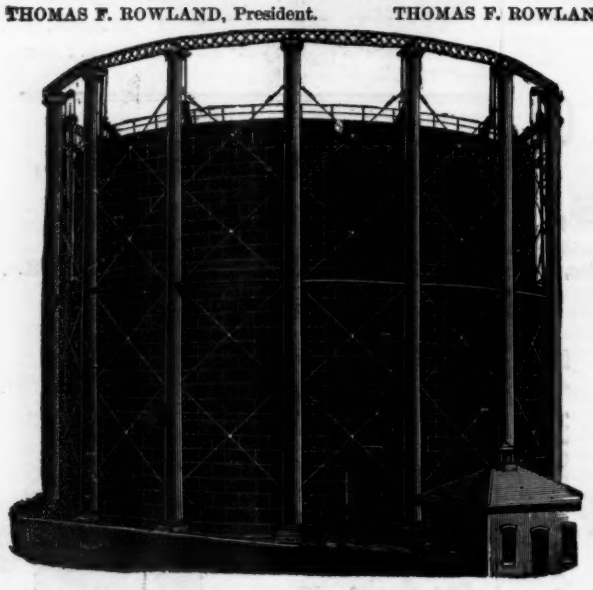
THOMAS F. ROWLAND, President. THOMAS F. ROWLAND, Jr., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.



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TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM NEW YORK TO GREENPOINT.

BUILDERS OF

# GAS HOLDERS.

**Single and Multiple Section Gas Holders a Specialty.**

## Wrought Iron Gas Holder Tanks.

**BENCH CASTINGS, RETORT LIDS.**

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc., Etc.

## SELF-SEALING RETORT MOUTHPIECES & LIDS.

**For Round, Oval, or "D" Retorts.**

# Reliable Gas Heaters, Parlor Grates and Radiators.

Three Distinct Lines.

Sixty Different Styles.

Ranging in Price from

$5.00 to $30.00.

**Send for 1894 Catalogue of Heating Stoves.**

New Designs and

Improvements for 1894.

The Largest and Most Complete Line ever Manufactured Under one Name.

# The SCHNEIDER & TRENKAMP CO.,

Sole Manufacturers of Reliable Gas Heaters.

**479-501 Case Ave., Cleveland, Ohio.**

# Jewel Gas Heating Stoves
## For 1893-94.

Send for Catalog of the Most Artistic Line of Heaters on the Market.

The New Double Reflector is Worthy of Attention.

**22 Styles. Prices from $4.50 to $12.**

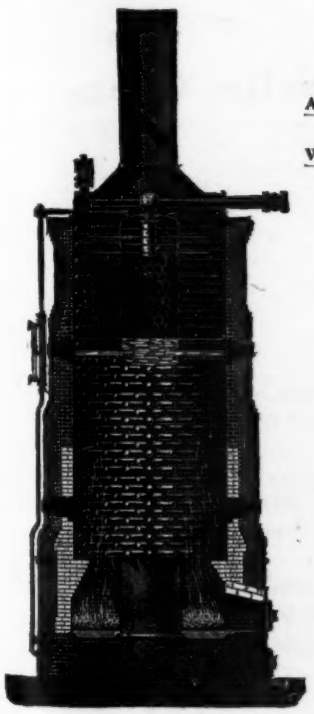
GEORGE M. CLARK & COMPANY,

MAKERS,

149-161 Superior St., Chicago.

# The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

**Patented in America and Abroad.**



## 100,000 HORSE POWER

**of this Justly Celebrated Water-Tube Boiler in Successful Operation in all the Principal Industries.**

**An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.**

**A Common-Sense High-Pressure Boiler made in a Superior Manner.**

**We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.**

**THE HIGHEST STANDARD OF EXCELLENCE.**

**Standard Sizes, 50 H.P. to 500 H.P.**

THREE REGISTERED
**THE HAZELTON BOILER.**

**THE PORCUPINE BOILER.**
TRADE MARKS.

**Special Sectional Boilers For Export.**

**The only Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.**

.·. BEWARE OF IMITATIONS. .·.

This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.

## THE HAZELTON BOILER CO.,

**Sole Proprietors and Manufacturers, NEW YORK, U. S. A.**

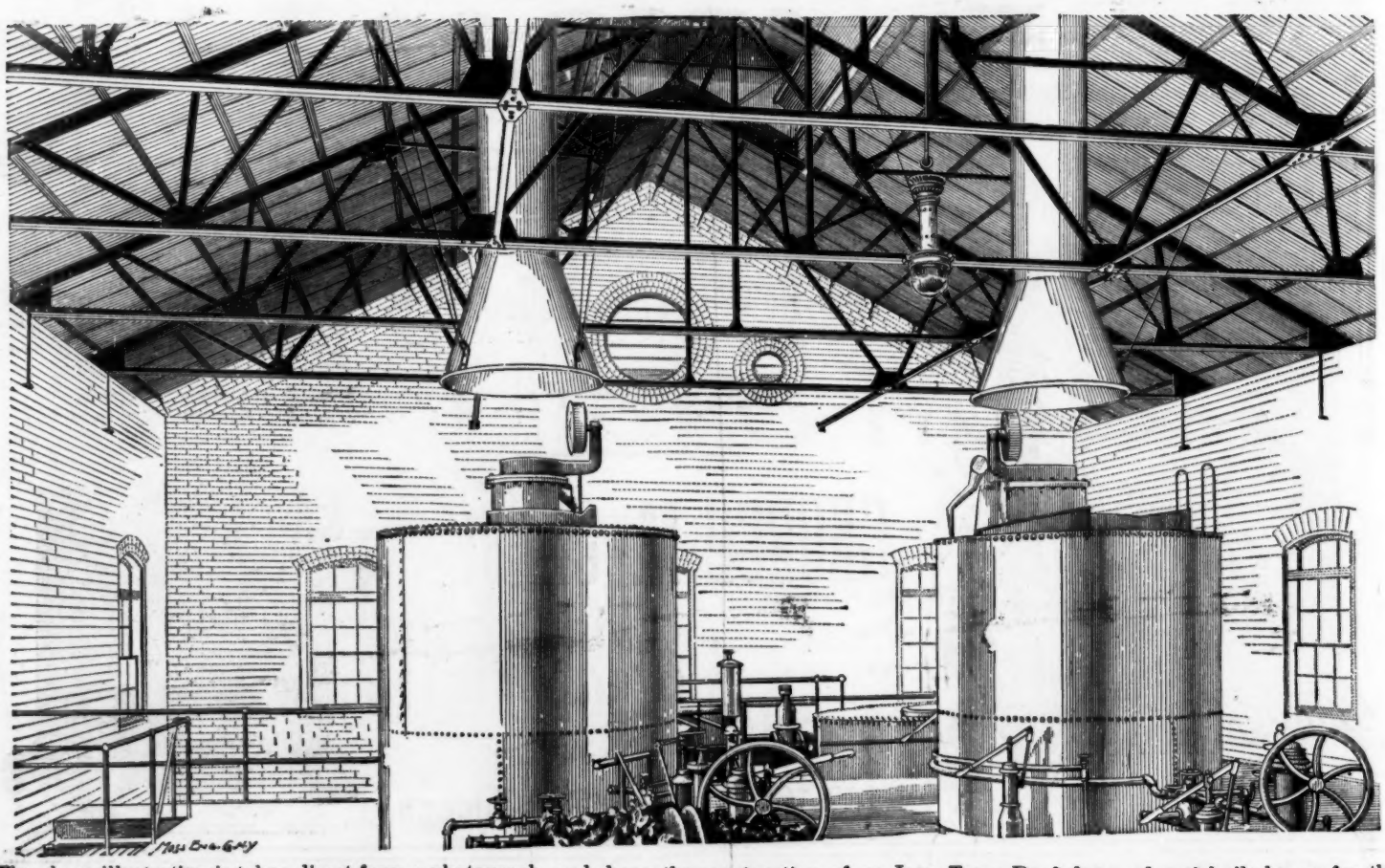
**Cable Address, "PAILA," NEW YORK.** **WRITE FOR ILLUSTRATED CATALOGUE. Correspondence Solicited.** **Long Distance Telephone, 1229-18th St., New York.**

This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries

**NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES.**

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

# THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Providence Gas Light Company, at Providence, R. I. The building is 40 ft. in width by 100 ft. in length, the side walls being of brick and the roof being entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The building is ventilated by our Improved Ventilator, extending the full length of the roof, with side shutters opened and closed by cords from the floor. No woodwork is used in any way about the construction of the building.

**Write for Illustrated Catalogue.**

**Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.**

## HIGH CANDLE POWER

FROM

## GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

| | Candle Power. | Pressure. | Gas Consumed. | C.P. per Cu. Ft. |
|---|---|---|---|---|
| Average of Test No. 1, | 67.05 | .95 in. | 2.6 | 25.70 |
| " " No. 2, | 63.86 | 1.00 in. | 2.86 | 22.30 |
| " " No. 3, | 72.50 | 2.1 in. | 2.87 | 25.26 |

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

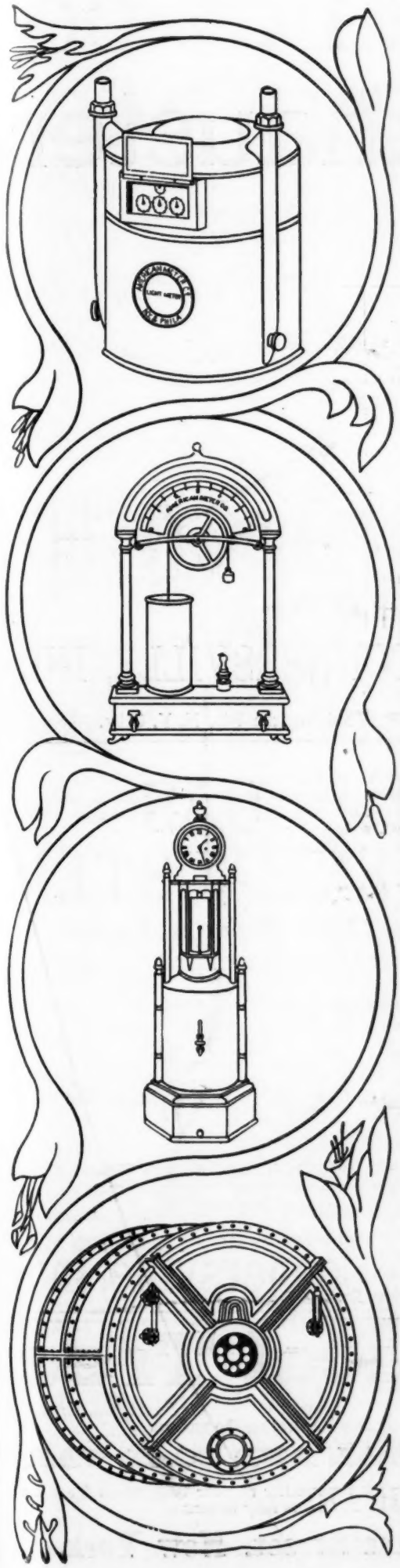
These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

WE ARE NOW PREPARED TO FILL ALL ORDERS PROMPTLY FOR

## HIGH CANDLE POWER WELSBACH LIGHTS.

**Gloucester, N. J. WELSBACH LIGHT CO.**



# AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

**NEW YORK and PHILADELPHIA.**

**CHICAGO, CINCINNATI,**

**ST. LOUIS, SAN FRANCISCO.**

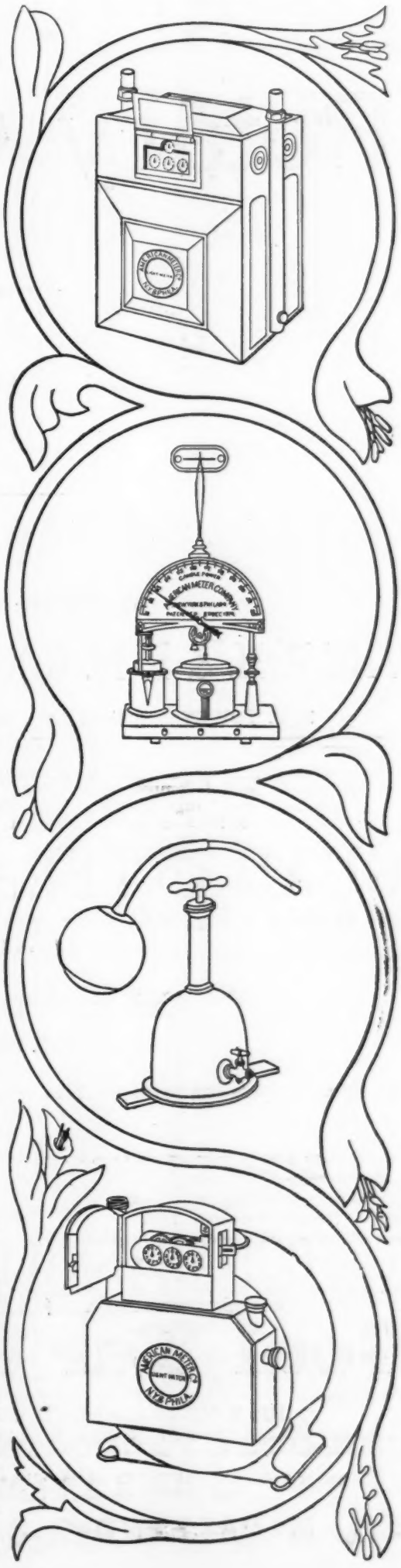
## PUBLIC LIGHTING TABLE.

### OCTOBER, 1893.

| Day of Week. | Date. | Table No. 1. Following the Moon. Light. | Table No. 1. Following the Moon. Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Table No. 2. New York City. All Night Lighting. Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M | A.M. |
| Sun. | 1 | 6.10 PM | 10.40 PM | 5.30 | 5.00 |
| Mon. | 2 | 6.10 LQ | 11.40 | 5.30 | 5.00 |
| Tue. | 3 | 6.10 | 1.00 AM | 5.30 | 5.00 |
| Wed. | 4 | 6.10 | 2.10 | 5.30 | 5.00 |
| Thu. | 5 | 6.10 | 3.20 | 5.30 | 5.00 |
| Fri. | 6 | 6.10 | 5.00 | 5.30 | 5.00 |
| Sat. | 7 | 6.00 | 5.00 | 5.30 | 5.00 |
| Sun. | 8 | 6.00 | 5.00 | 5.20 | 5.10 |
| Mon. | 9 | 6.00 NM | 5.00 | 5.20 | 5.10 |
| Tue. | 10 | 6.00 | 5.10 | 5.20 | 5.10 |
| Wed. | 11 | 6.00 | 5.10 | 5.20 | 5.10 |
| Thu. | 12 | 6.00 | 5.10 | 5.20 | 5.10 |
| Fri. | 13 | 6.00 | 5.10 | 5.20 | 5.10 |
| Sat. | 14 | 6.50 | 5.10 | 5.20 | 5.10 |
| Sun. | 15 | 7.40 | 5.10 | 5.10 | 5.20 |
| Mon. | 16 | 8.40 | 5.10 | 5.10 | 5.20 |
| Tue. | 17 | 9.40 FQ | 5.10 | 5.10 | 5.20 |
| Wed. | 18 | 10.40 | 5.10 | 5.10 | 5.20 |
| Thu. | 19 | 11.50 | 5.10 | 5.10 | 5.20 |
| Fri. | 20 | 12.50 AM | 5.20 | 5.10 | 5.20 |
| Sat. | 21 | 2.00 | 5.20 | 5.10 | 5.20 |
| Sun. | 22 | 3.10 | 5.20 | 5.00 | 5.30 |
| Mon. | 23 | No L | No L. | 5.00 | 5.30 |
| Tue. | 24 | No L | No L. | 5.00 | 5.30 |
| Wed. | 25 | No L FM | No L. | 5.00 | 5.30 |
| Thu. | 26 | 5.30 PM | 6.50 PM | 5.00 | 5.30 |
| Fri. | 27 | 5.30 | 7.30 | 5.00 | 5.30 |
| Sat. | 28 | 5.30 | 8.30 | 5.00 | 5.30 |
| Sun. | 29 | 5.30 | 9.30 | 4.45 | 5.35 |
| Mon. | 30 | 5.30 | 10.50 | 4.45 | 5.35 |
| Tue. | 31 | 5.30 LQ | 12.00 | 4.45 | 5.35 |

### TOTAL HOURS LIGHTING DURING 1893.

| By Table No. 1. | Hrs.Min. | By Table No. 2. | Hrs.Min. |
|---|---|---|---|
| January... | 217.30 | January... | 423.20 |
| February.. | 200.30 | February.. | 355.25 |
| March .... | 177.50 | March .... | 355.35 |
| April..... | 160.30 | April..... | 298.50 |
| May..... | 149.00 | May..... | 264.50 |
| June..... | 140.30 | June..... | 234.25 |
| July ..... | 143.40 | July..... | 243.45 |
| August.... | 154.50 | August.... | 280.25 |
| September. | 171.50 | September. | 321.15 |
| October.... | 202.20 | October.... | 374.30 |
| November. | 221.30 | November. | 401.40 |
| December. | 248.50 | December. | 433.45 |
| Total.. | 2188.50 | Total.. | 3987.45 |



# Roots' Rotary Gas Exhauster

IF a President, Secretary or Superintendent of any Gas Company wishes one of our handsome GAS EXHAUSTER Paper Weights, please let us have your address, and we will take pleasure in sending you one, with our compliments.

**SEND FOR DESCRIPTIVE CATALOGUE AND PRICES.**

THE P. H. & F. M. ROOTS CO., Patentees and Manufacturers CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., COOKE & CO., Selling Agts., 163-165 Washington St., N. Y. City.

WE GUARANTEE THE BEST DESIGNED, . . THE BEST CONSTRUCTED, THE SMOOTHEST RUNNING, THE MOST ECONOMICAL, . THE MOST EFFICIENT . . GAS EXHAUSTER

NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

**CYCLOIDAL EXHAUSTER,**

the internal operating parts of which consist of two Revolvers, each p'aned accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

**Correspondence Solicited.**

The CONNERSVILLE BLOWER CO., Connersville, Ind.

# Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng., having compiled a novel Chart or Map illustrating the various

**CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,**

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

**A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.**

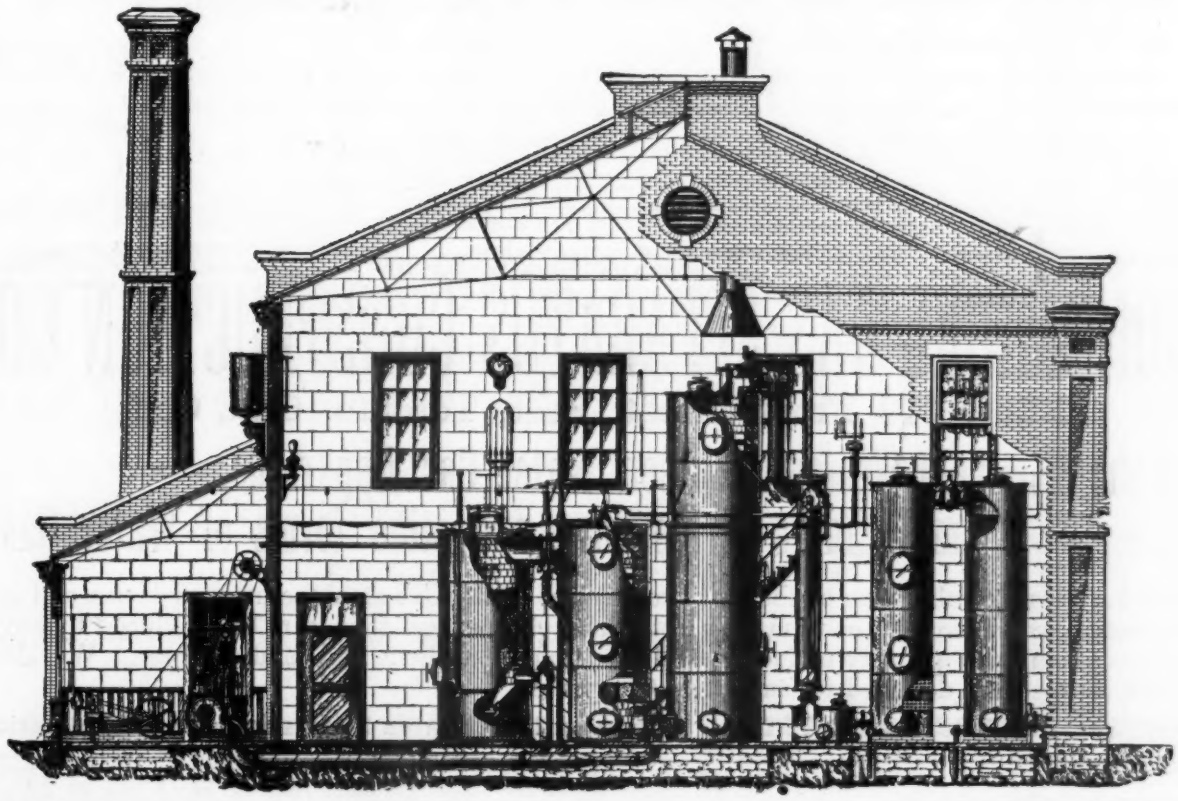
# THE UNITED GAS IMPROVEMENT CO.,

## DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

## THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

**PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.**

## "Now Cometh the Winter of Our Big Output,"

AND NEED OF INCREASED CAPACITY.

We are

# THE WESTERN GAS CONSTRUCTION COMPANY,

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GAS ENGINEERS AND BUILDERS OF

## THE IMPROVED LOWE WATER GAS APPARATUS.

It is not the only thing we build, but one of the many things we build WELL, and the near approach of the dark season makes it the most interesting thing to talk about JUST NOW. Therefore WE SAY our installments so far this year aggregate a total daily capacity of 3,800,000 cu. ft. per diem. We think if you are interested, this will warrant your writing us for particulars.

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W. H. PEARSON, President. J. T. WESTCOTT, Gen'l Mang'r & Treas. (Formerly with The United Gas Improvement Co.) L. L. MERRIFIELD, Chief Engineer. (Formerly with the United Gas Improvement Co.)

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Office, 269 Front Street, East, Toronto, Ont., Can.

## Owners of the Merrifield-Westcott-Pearson Water Gas Apparatus, and Builders of the Lowe and other forms of Water Gas Plants.

Our system includes a combination of the best processes of Water Gas manufacture now in use, and an apparatus of novel construction, which enables us to make a better and cheaper gas than can be produced by any other process. Guarantees given as to quantity of fuel and oil used, make per diem, and candle power. We also make an apparatus which is especially designed for small Gas Companies.

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Analyses of Coals, Purifying Materials, Gas, Gas Liquor, Water, and all Technical Products. Photometric and Calorimetric Determinations.

**122 Bowery, New York City.**

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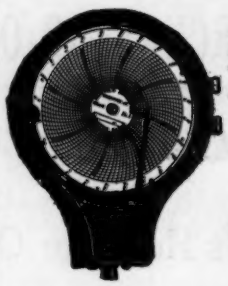
BRISTOL'S RECORDING **PRESSURE GAUGE**

For Continuous Records of

**Street Gas Pressure.**



Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

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Waterbury, Conn.

See our Exhibit at World's Fair.
Machinery Hall Section 25 M—24.

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Special Trays for Iron Sponge or Oxide of Iron.

**CHURCH'S TRAYS a Specialty.**

Reversible, Strongest, Most Durable, Most Easily Repaired.

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We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.

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SOLE OWNERS OF THE REW SOFT COAL CARBURETED WATER GAS APPARATUS.

Guaranteed Estimates of Cost of Gas in Holder Furnished upon Application.

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(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

**"IRON SPONGE."** Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

**AUTOMATIC GOVERNOR.**

OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT!
WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

**STEAM JET EXHAUSTER.** Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

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# WILBRAHAM BAKER BLOWER COMPANY,

**Successors to WILBRAHAM BROS.,**

Philadelphia, Pa.,

SOLE MAKERS OF

# THE HUNTOON GAS GOVERNOR,

The Best Governor in the Market for Rotary or Steam Jet Exhausters.

## Wilbraham Gas Exhausters,

BAKER ROTARY PRESSURE BLOWERS,

And Rotary Piston Pumps.

**Catalogues and Prices on Application.**

# IRON MASS

For Gas Purification.

**Acts immediately, and more efficiently than any other purifying agent now in use.**

## Greenpoint Chemical Works.

**JOHN SCHRIEVER, Manager.**

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

# DOUGLAS' FERRIC OXIDE

**For Gas Purification**

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

Full information, with references to many users, and prices delivered in any locality, furnished on application to

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GAS COALS. CANNEL COALS. COKE CRUSHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

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Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

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The Youghiogheny River Coal Company's

**OCEAN MINE YOUGHIOGHENY GAS COAL.**

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ALSO, SOLE SHIPPERS OF THE

**Old Kentucky Shale, From Kentucky.**

TRADE **O. K. SHALE.** MARK.

**THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.**

S. CALVERT FORD, Government Inspector at Washington, pronounces this Shale

**"ONE OF THE BEST GAS ENRICHERS THAT HAS BEEN OFFERED TO THE TRADE."**

He reports it as giving:

12,553 Cubic Feet of 50-Candle Gas,
or 10,460 Cubic Feet of 60-Candle Gas,

AN EQUIVALENT OF 627,650 CANDLE FEET,

And 808 Pounds of Merchantable Coke.

Single Carloads or more delivered at any required point in the United States or Canada.

**Cargo Shipments from NEW YORK, PHILA., BALTIMORE and NEWPORT NEWS.**

JAMES & WILLIAM WOOD,

**Gas and Cannel Coal Contractors,**

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Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

**STANDARD CANNELS,**

**Unequaled as Gas Enrichers.**

Analyses, prices, and all further information furnished on application to

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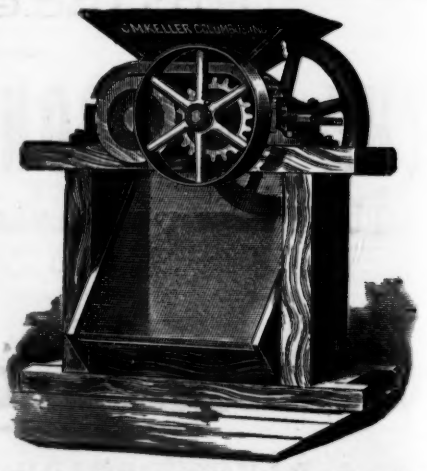

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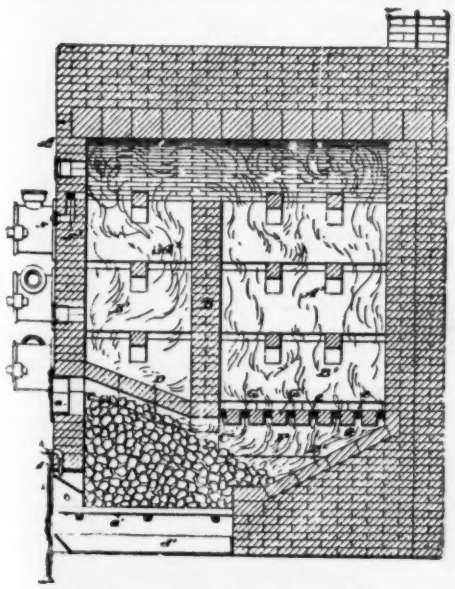

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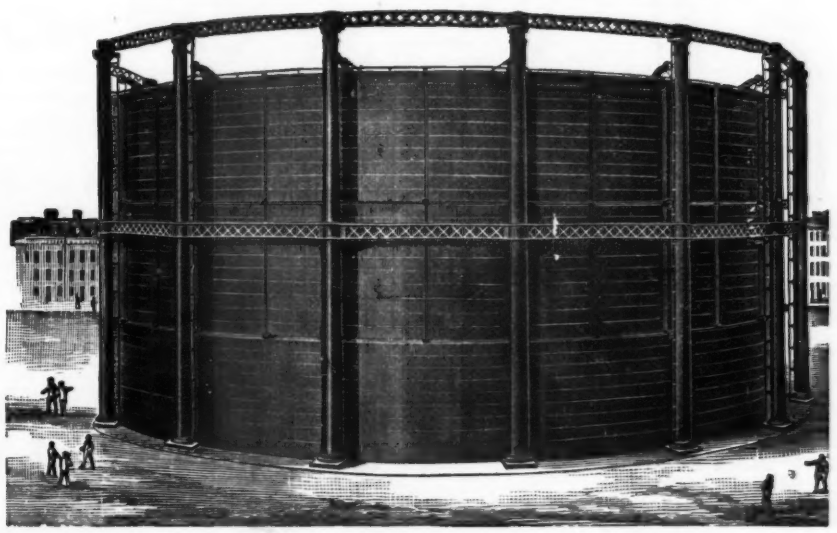

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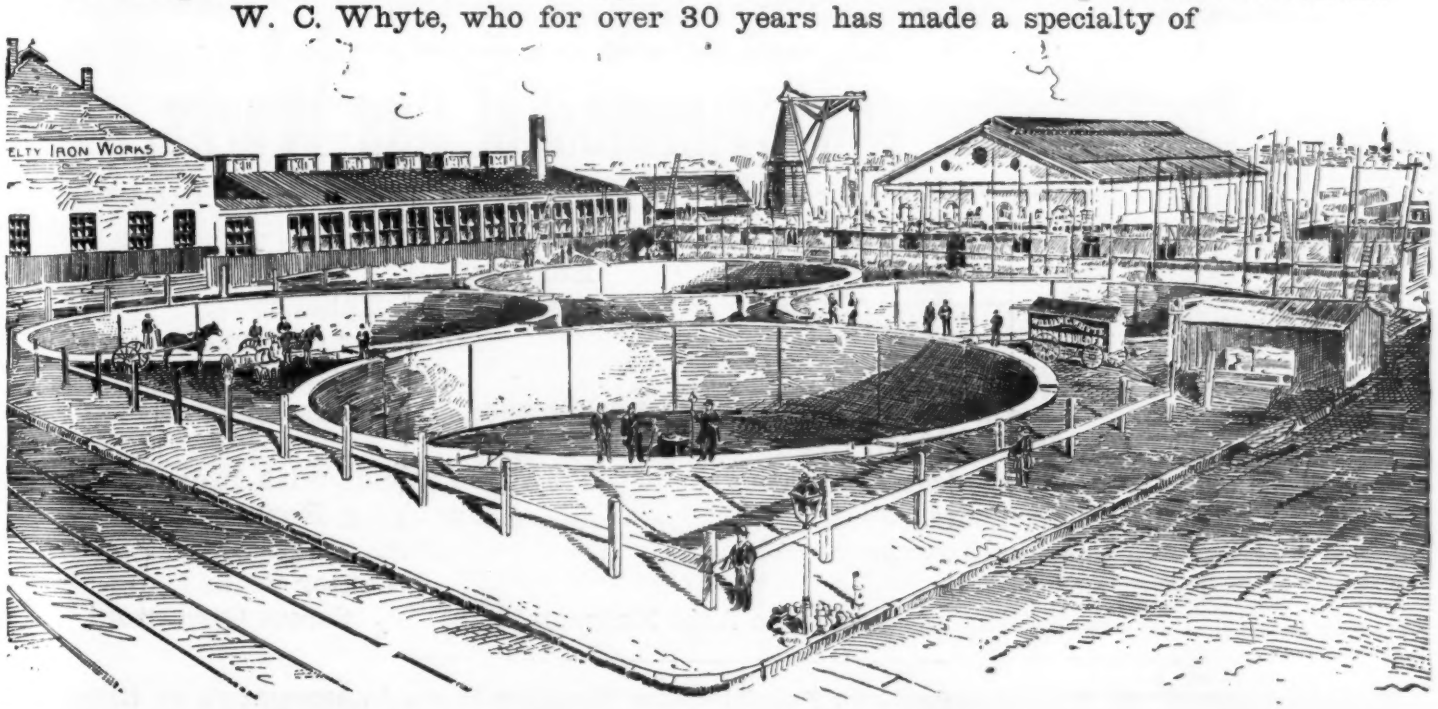


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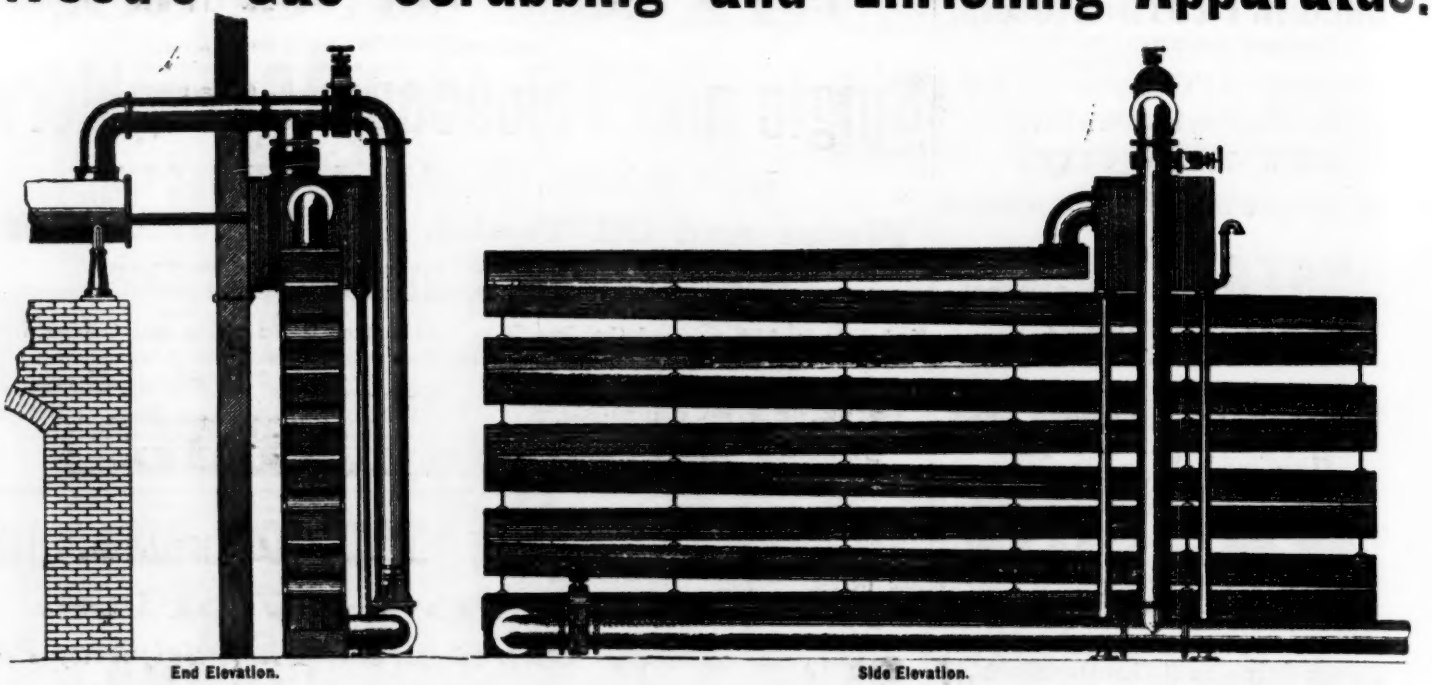

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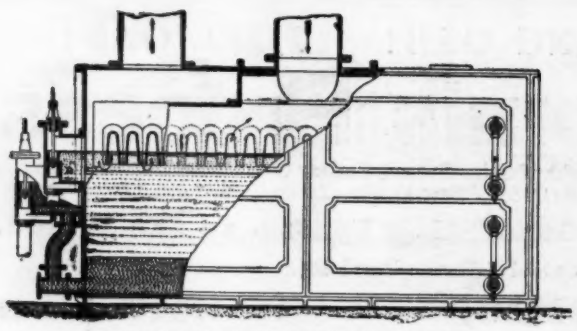

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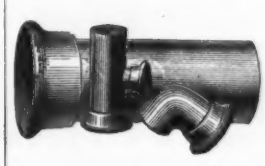

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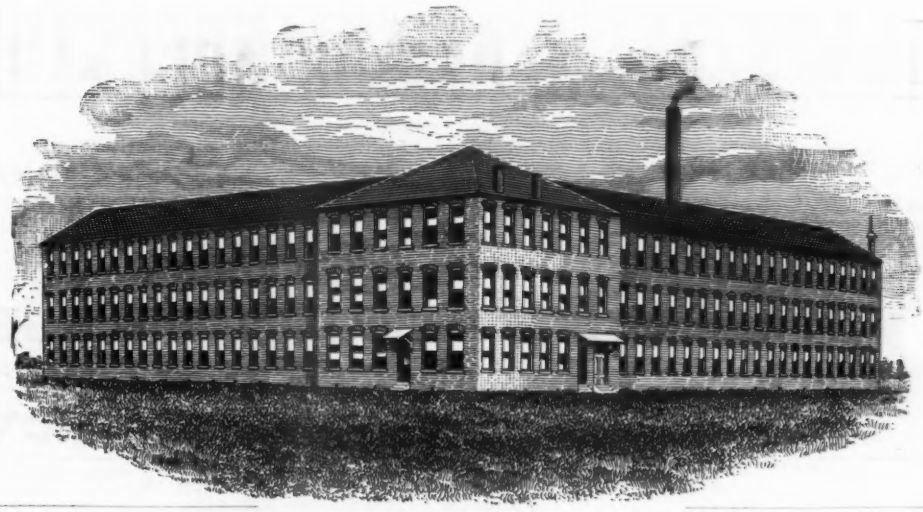

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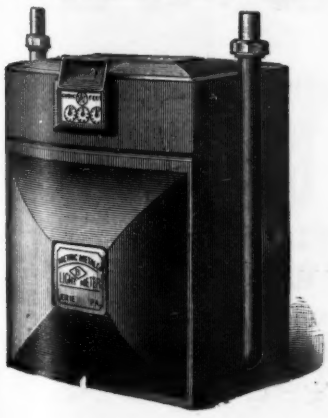

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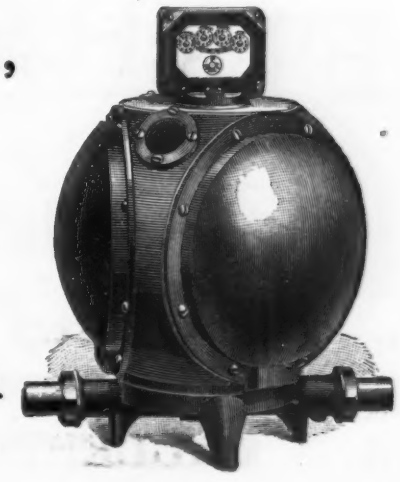

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## METERS FOR MEASURING GAS

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Apparatus for the Chemical Testing of Gas and Gas Liquor.

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## "Success" and "Perfect" Gas Stoves.

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## Manufacturers of Wet and Dry Gas Meters,

**STATION METERS, METER PROVERS,**

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

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# THE AMERICAN METER CO.

**Established 1834. Incorporated 1863.**

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

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**GAS STOVES.**
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

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## GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

**WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,**

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works

**FOULIS' PATENT STATION AND DISTRICT GOVERNORS.**

**REPAIRING DEPARTMENT.**—We employ a special force of skilled workmen repairing meters of **all makers.**

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## Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

**Meters of all makers Thoroughly Repaired.**

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STATION METERS.
METER PROVERS.
REPAIRING.

**SPECIAL.**—Having purchased the sole right to manufacture and sell meters with the HEARNE IMPROVED VALVE, in the U. S., we respectfully solicit orders for the same.

The superior feature of this meter is that it avoids the danger of displacement of the valves, and consequent loss of gas, either in shipping, handling, or by dishonest consumers.

To designate from the regular Glover Meter, also made by us, we style the above the HEARNE-GLOVER Meter.

It is worth your consideration.

Full descriptive circular sent on application

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**1012, 1014 & 1016 Filbert Street, Philadelphia, Pa.**

Agent, GEORGE B. EDWARDS, 113 Chambers Street, N. Y. City.

SOLE MANUFACTURERS OF THE

# "Sun Dial" Gas Stoves,

**IN A GREAT VARIETY OF STYLES AND SIZES.**

Gas Cooking Stove No. 7 C.

## The Most Economical, Efficient, and Durable Gas Stove Made.

*SIZE.*

| *Stove.* | *Oven.* | *Broiler.* | *Top.* |
|---|---|---|---|
| 31 inches high. | 9¼ inches high. | 10 inches high. | 21 inches high. |
| 17 inches wide. | 15 inches wide. | 15 inches wide. | 16 inches wide. |
| | 12¼ inches deep. | 12¼ inches deep. | |
| | Length over extension shelves, 32 inches. | | |

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1¼ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1¼ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

**Catalogue showing Styles and Prices sent free on application.**

# DRY and WET GAS METERS

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

**METER PROVERS (Sizes 2, 5 and 10 feet.)**

**Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.**

**DRY & WET CENTER SEALS, DRY & WET GOVERNORS, EXHAUSTER GOVERNORS.**

**Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus Complete.**

**Also, TESTING AND CHEMICAL APPARATUS OF ALL KINDS, AND OF THE MOST PERFECT DESCRIPTION, FOR ALL PURPOSES RELATING TO GAS.**

## GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

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